THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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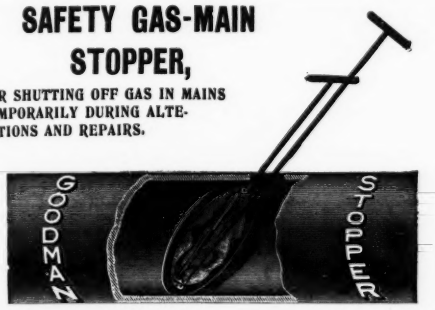

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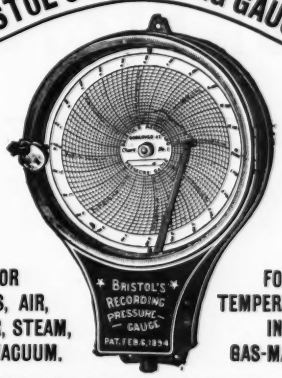

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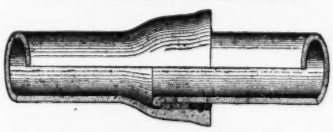

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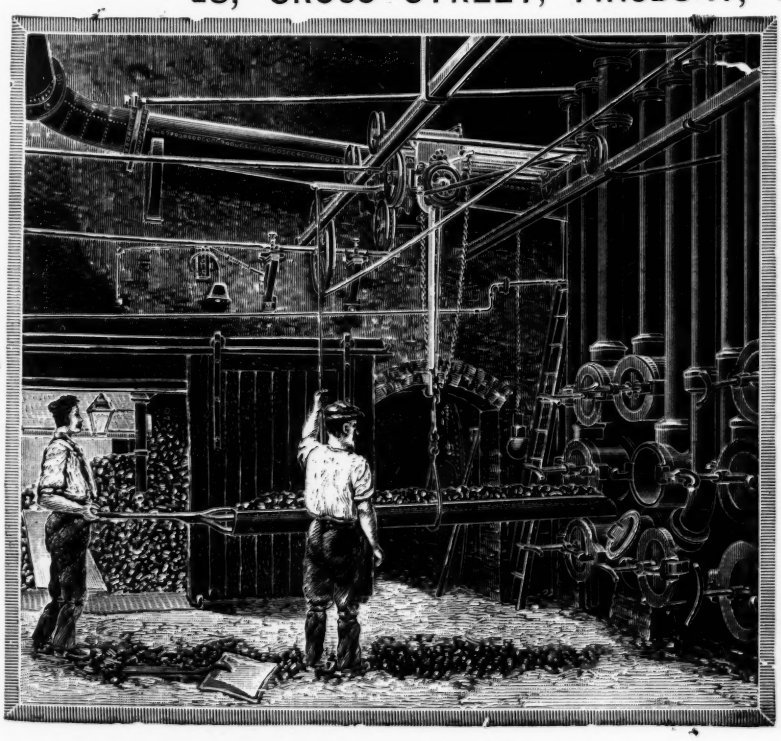

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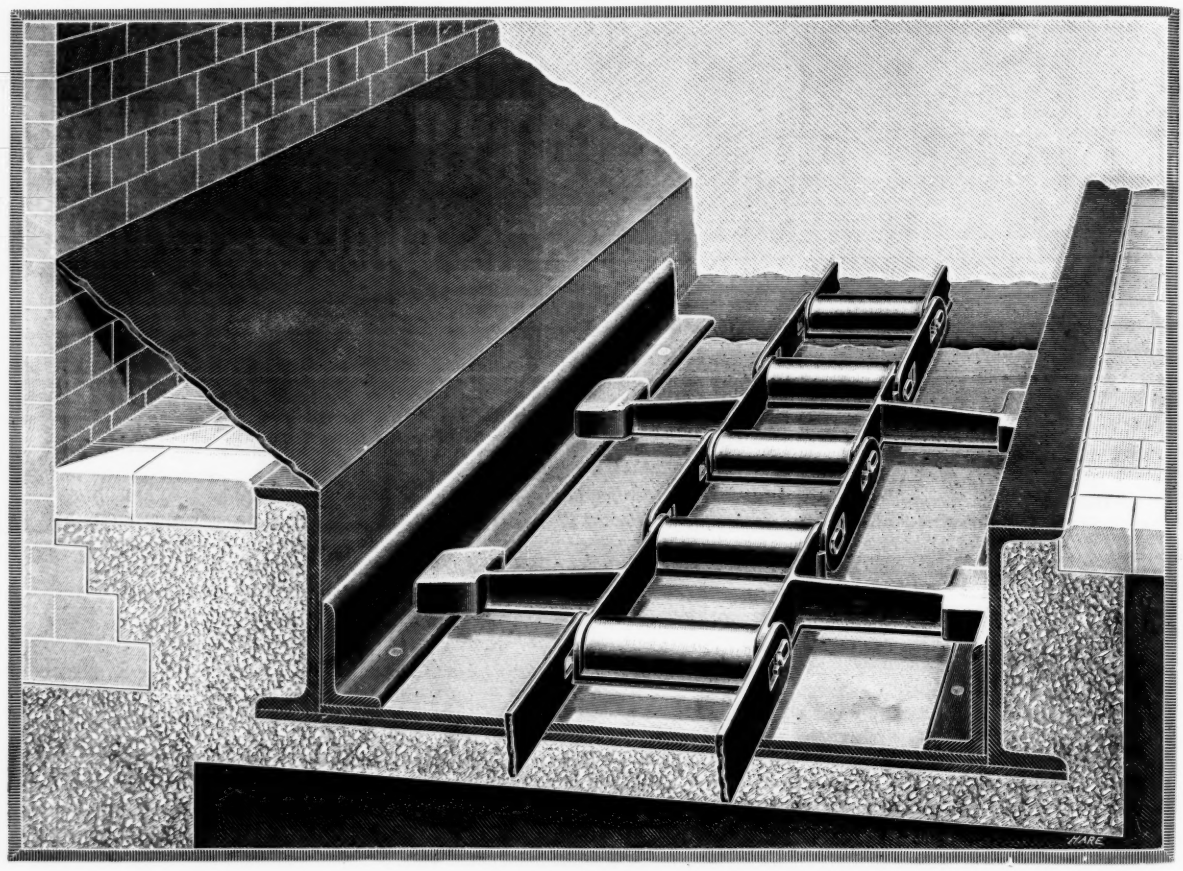

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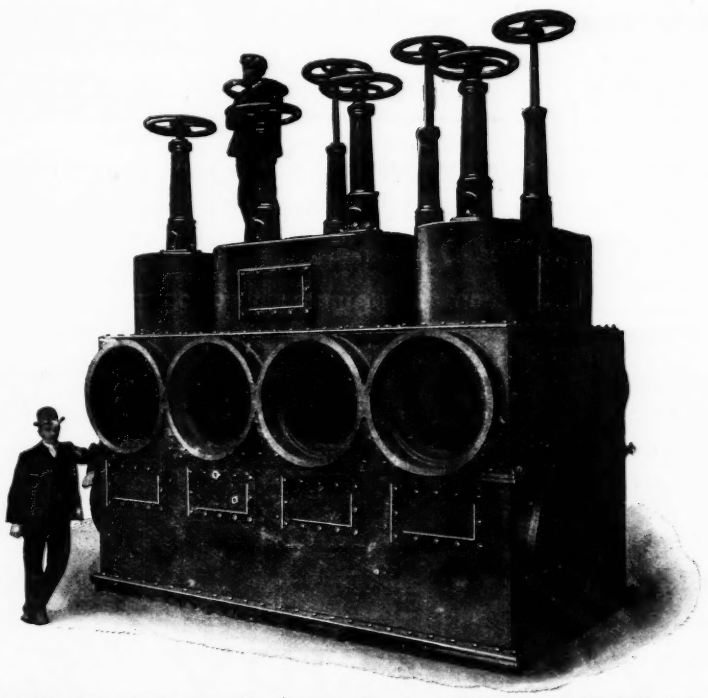

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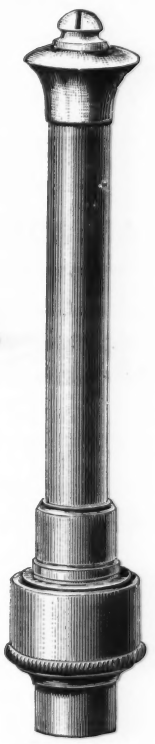

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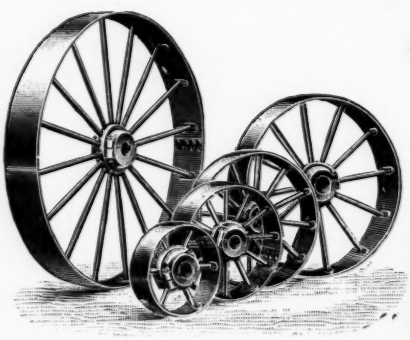

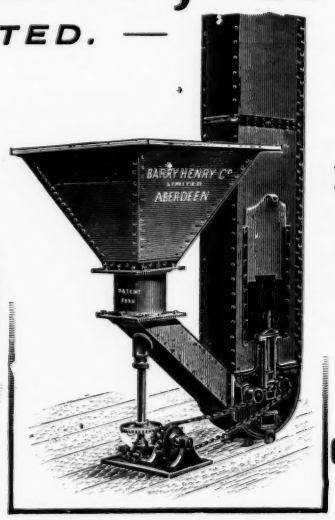

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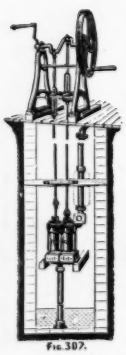

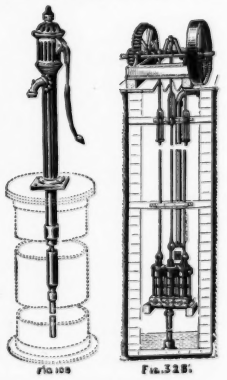

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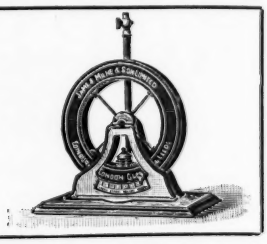

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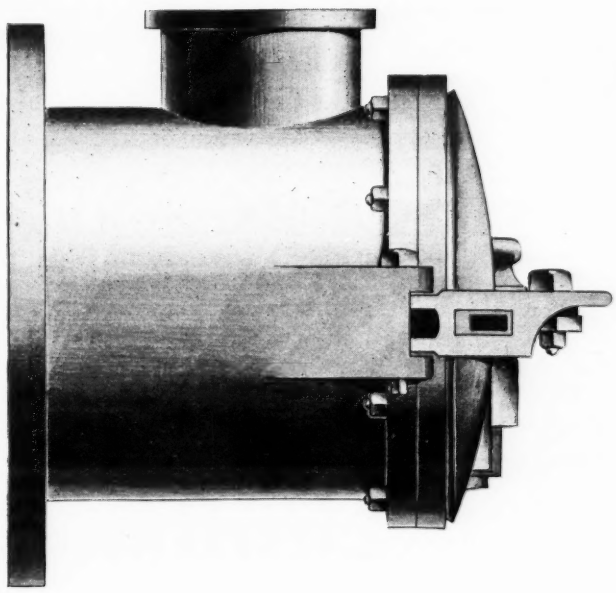

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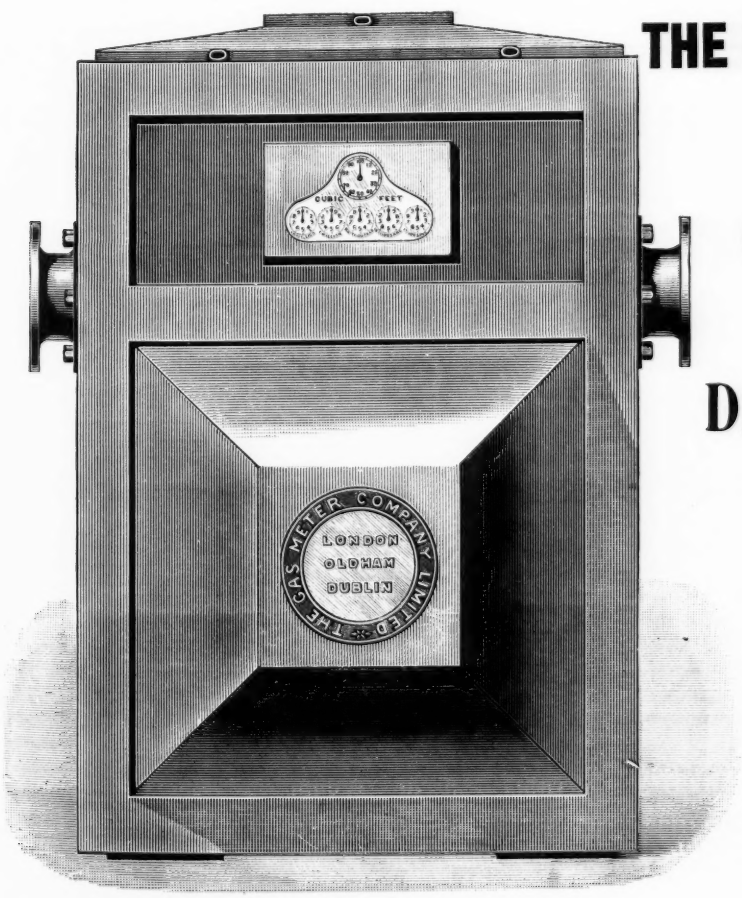

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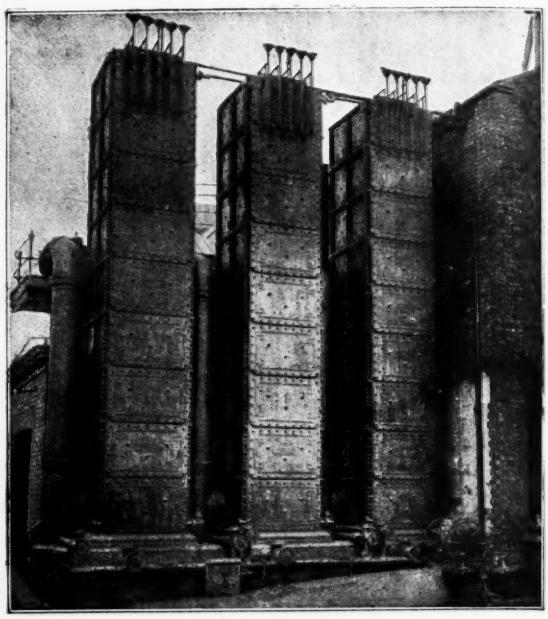

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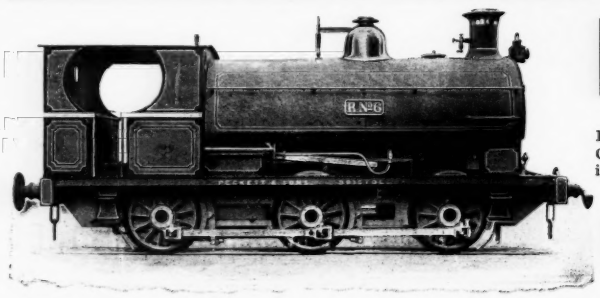

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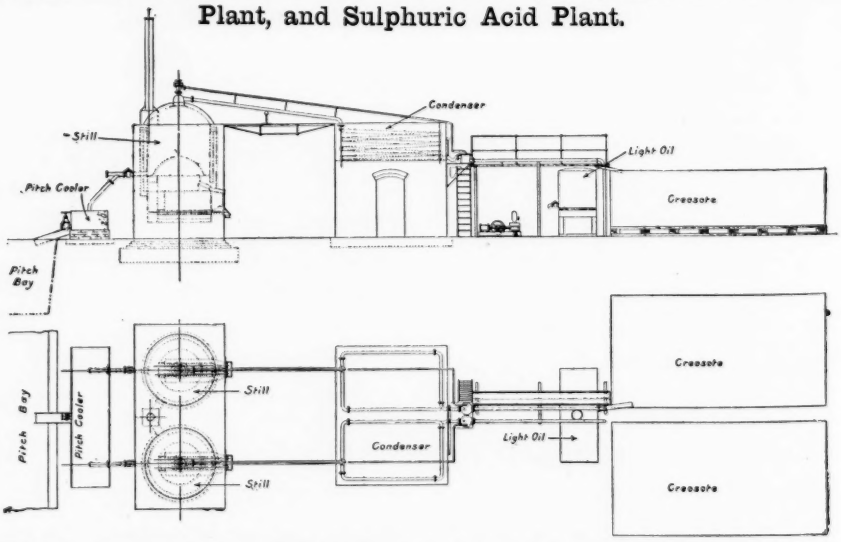

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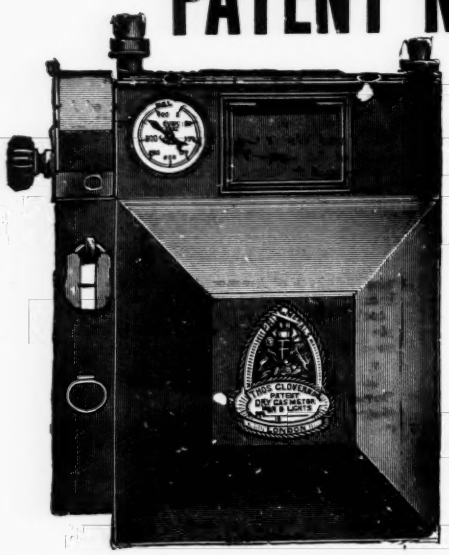

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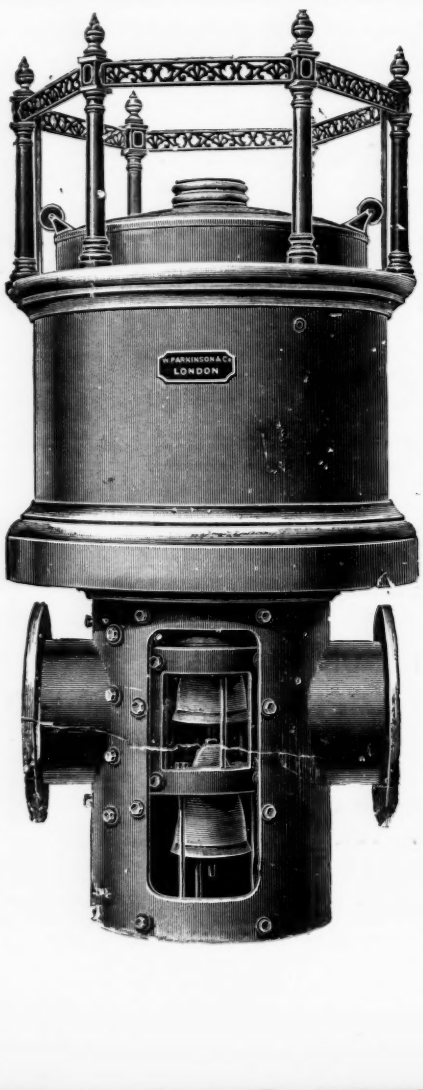

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EDITORIAL NOTES.

The End of the Granton Articles.

WITH the publication this week of a general plan (accompanied by a short explanation) of the finished section of the new Granton works of the Edinburgh and Leith Gas Commissioners, we come to the end of the exceptionally interesting and informative series of articles by Mr. W. R. Herring, the Engineer, which articles, with the plates and illustrations, have made a special feature week by week, with only two or three omissions, of the issues of the "JOURNAL" this year. We may, however, yet prevail upon Mr. Herring to go a step farther, and give us, as early as possible, a separate description of the chemical works, which gas engineering visitors to Granton never (or, if they do, they make a mistake) miss inspecting. It was not Mr. Herring's intention to supplement the articles on the gas-works proper by an account of the chemical works. Very modestly he suggests that there is nothing new in them, and "many "things have cropped up" since they were designed and erected. The latter statement is a little ambiguous; but even if it be granted, to please Mr. Herring, that there is nothing new in the chemical works, we are not prepared to accept this as an excuse for not giving a general description of them to round off the account of his work at Granton. It has been our pleasure to visit the chemical works on more than one occasion; and even if they did not at first come up in every particular to Mr. Herring's expectation, they are at all events unsurpassed in their completeness among such works on a similar scale. We must therefore try to hold him to his promise to give us the description later on, and would suggest that its value would be enhanced if, in the preparation, he would state where and in what particulars, in the light of his experience with them or with his knowledge of subsequent invention, he thinks they could be improved, and by what means.

In the number in which the first of Mr. Herring's articles was published, there appeared an editorial appreciation of the work that he had undertaken in connection with them. With the close of the series to-day, we say, without fear of contradiction, that the result has fully justified that preliminary appreciation. Mr. Herring has once more shown his mastery of the art of clear and attractive exposition, even when dealing with technical and complicated details; and his drawings have demonstrated a refinement and degree of care in preparation which tell of the love for precision in the master-mind and of its diffusion throughout the staff who have been engaged upon the work. At the beginning of the series of articles, it was stated that the author desired, in order that the character of the new works should be presented completely, to treat them with detailed fullness. With this week's publication, the articles have extended through 27 issues of the "JOURNAL," the plates have been equal in number, several supplementary drawings have been incorporated in the text, and the reproductions of photographs taken during the construction of the works number close upon 140. In the midst of his multifarious work at the present time, this literary performance by Mr. Herring is a striking one; and as a descriptive account of a large new gas-works, it is certainly unprecedented. The works themselves have enabled the author to render it so; and he alone it was who made the works what they are, and worthy of such extended treatment.

As we have seen as the description has been unfolded to view, the main principle underlying this great gas-works scheme has been automatic and mechanical action and operation; and this has been carried to the extreme point to which the situation and extent of the works lend themselves. Yet this does not, even including all that is consequential to that paramount principle, embrace by a long way the last in the train of the many important engineering features that have come before us in the course of the past six months. It may be said, and the articles sustain the statement, that we know of no single gas-works throughout the length and breadth of the country in which so much that is novel has been embodied as is found in these works at Granton. We cannot draw attention to all these things in this brief editorial notice. To do so would necessitate the epitomizing of the whole of the 27 articles which comprise the series. Nor can we discuss here the wisdom of the choice of the means which Mr. Herring has adopted to gain his end, and that end is the cheapening in Edinburgh of the works costs per ton of coal carbonized or per 1000 cubic feet of gas output. Mr. Herring has stated completely what these means are; and he leaves them to the judgment of his professional fellows. He himself has naturally a supreme faith in the power of the plant to achieve his object; and whatever may be the measure of success, he will, we know, be the last man to hide it from his engineering colleagues. He has already, as will be seen in our issue for June 16 (p. 744), shown what he has so far succeeded in accomplishing in the reduction of the working expenses; and what he ultimately expects to do in this respect is to be gathered from his speech at the inauguration of the works some few months since—that is, to give the gas consumers of Edinburgh and Leith these works "at practically no cost "to themselves; for," he asserts, "the economies which can "be brought about in the new works will be sufficient not "only to pay interest and sinking fund charges on the capital "outlay, but also to allow of two or three coppers being "taken off the price of gas." The full realization of this anticipation will more than justify the principle which ruled in the planning of the Granton works, which have been very aptly described as a "monument" to the engineering skill of their designer.

We have gone a little astray from the original purpose of this reference, which was simply to acknowledge our great appreciation and indebtedness—and we are sure that this is also the expression of the feelings of all engineering readers, whatever may be their views on the subject of inclined retorts and other labour-saving devices—to Mr. Herring for the time, trouble, and care that he has expended upon his unique series of articles, drawings, and photographs. The interest and usefulness attaching to their publication will be something more than passing; their full value will be acknowledged far away in the future—compacting as they do within their scope all the ideas of an advanced engineer of the note of Mr. Herring as to what a gas-works of the magnitude of those at Granton should be at this period and at this stage of knowledge in gas-works construction and methods.

Gas Companies and Economical Burners.

THERE is a proverbial saying to the effect that if the lamest lie once gets a little start, it is hardly possible for Truth to overtake it. The old Welsbach Company were in the habit of defending their remarkable commercial methods on the ground that the gas companies were their natural enemies, because incandescent gas-burners economized gas. Until something happened to sweep them all away, these credulous amateurs ceased not to proclaim this tenet of theirs, to the discredit of those who would have been their best friends. One never knows how long the echoes of old errors will linger in quiet corners; but it was rather surprising to discover the other day, in a leading electrical journal, a repetition of the stale old calumny that gas companies "at first were opposed to improvements in gas-"burners," and needed to be taught by experience that every such improvement is to their advantage. It should not be necessary to formally deny this impeachment; yet it will probably not be waste of labour to show that it never had the slightest foundation in fact. Every real or even promising improvement in gas-lighting burners received the benevolent recognition of the leaders of the gas industry as it arose; but, until quite recent times, it was impossible for gas companies to take an active part in the popularization of any gas-consuming appliances. It was not the practice of gas companies to take any cognizance of what happened to gas after it had passed the consumers' meters; neither was it

understood that they had legal warranty for interesting themselves in what became of the gas beyond this stage of its distribution. If it was the celebrated judgment of the House of Lords in the Nine Elms case that destroyed the idea, this decision, though much discussed at the time, was a disguised blessing.

What caused the gas companies to look askance at the Welsbach burner for so long a period after its somewhat mysterious introduction, was something very different from its economy of gas. There were many reasons for this attitude of reserve on the part of the gas companies; but the preponderating one was hesitation to believe that the British public, previously so incurious in all such matters, would ever go to the considerable expense and take the trouble with the mantles merely for the sake of the small saving of gas. It was not unreasonably thought that Continental frugality, moved by the higher price of gas, would have this effect; but as regards extravagant Englishmen, and still more extravagant Americans, there was nothing in experience to encourage a belief in any such result. This scepticism, be it observed, was quite justified so long as the Welsbach light could not claim a high degree of brilliancy. It was the second birth of the invention, not merely as an economical gas-burner, but really as the most brilliant light available for general use, that saved it. The British public do not favour the incandescent light to-day because it is the cheapest light known—although, of course, this is by no means a negligible advantage. The light is popular mainly because of its peculiar brightness. This fact is further proved by the failure of the small types of burner to attain in England the popularity they have always enjoyed on the Continent. The economy of incandescent gas lighting, as well as its brightness, and the advantages of a lessened number of burners, commend themselves to the private householder; but for business premises the lighting bill may remain pretty much as usual, while the advantage is sought in the greatly increased brightness. Our electrical friends should bear this in mind, as it may be confirmed by their experience with the Nernst light, which will owe to the same consideration such favour as it will receive.

North-Western Electricity and Power-Gas Bill.

The Mond gas scheme of the session has not met with an equable fate. To speak by the card, the North-Western Electricity and Power-Gas Bill, after experiencing a dazzling measure of success in the Committee of the Lords, was so grievously maimed last week by the Commons Committee, without any hearing of the remaining opponents, that it just survived the treatment. By the time these lines are in our readers' hands, the Bill may have received its *quietus*. At the adjournment on Thursday, it was left to the promoters to call one more witness, to satisfy the Committee, if possible, upon the financial aspect of the scheme with the whole of Cheshire struck out, and the original provisions as to capital left standing. Such a dramatic reverse of fortune must have taken the promoters entirely unaware. It will be remembered that the Bill originated with the ingenious idea of Mr. John Sturgeon, formerly of the Birmingham Compressed Air Power Company, to combine a business in bulk electricity with the distribution of Mond gas over an area of about 2000 square miles of the North-West of England. The district "pegged out"—to use the expression applied to the proposal throughout the parliamentary proceedings—comprised the whole of Cheshire, Derbyshire, Flintshire, Denbighshire, and North Staffordshire.

Naturally, the proposition stirred up a veritable hornets' nest of opposing interests round about the promoters' ears. They were prepared for this; and as it was mostly inspired by fears for the security of small and sectional interests, the opposition in the first House failed to stem the triumph of the sweeping generalities relied upon by the promoters. The Lords refused to exclude the districts of the opposing gas and electricity supplying companies and local authorities; but they struck out certain highly objectionable proposals of the Bill. As deposited, the measure would have empowered the Company to deal in land, and to finance their customers. The right to supply power and fuel gas was also restricted to Mond gas, properly so called, whatever this may be. The opposition before the Lords' Committee therefore gained a good deal; while the promoters had every reason to be satisfied with the reception accorded to their main project. They were given the important territory they had staked out, which was the chief thing.

At any rate, in the interval between the proceedings in the two Houses, certain conclusions were arrived at. The promoters excluded the city of Chester, for which the Corporation did not desire any additional manufacturing facilities. Fourteen associated Gas Companies, who had fought the Bill as one, thought better of it, and decided to fight no more. But there remained a stalwart few opponents determined to contest the matter to the bitter end; and these all hailed from the northern fringe of the county of Chester, where it marches with industrial Lancashire and with the mercantile Mersey. From Wallasey, on the extreme west, to the corner of the county wedged in between Lancashire and Derbyshire on the north-east, the opposition of the border came with all the added strength of concentration. Warned by experience, the opponents fastened upon the financial and other weaknesses of the Bill and the scheme; and they had their reward. The promoters were so confident of success, that they did not even give themselves the time and trouble to establish their case—merely putting their chief witnesses in the chair, and leaving them to the tender mercies of cross-examining Counsel. The result was to convince the Committee that the scheme was too ambitious; and they very early gave an intimation that Cheshire must be excluded from the scope of the Bill.

This was a heavy blow to the promoters, who had staked their hopes upon their attractive title. It could be no more the "North-Western" undertaking, with all Cheshire left out. Not by any stretch of language can Staffordshire be called the North-West of England. As a matter of fact, the only manufacturing area left in the Bill is the Potteries. With Cheshire also go two of the scheduled generating stations, leaving only the one at Stone, and an outlier in Denbighshire, which is not greatly demanded. Assuming that the strong financial evidence asked for by the Committee is forthcoming to-day, the proximity of the Potteries to the South Staffordshire area, where the only other Mond Gas Company are working out their destiny, is clearly not an advantage for the launching of another experiment on parallel lines. The parliamentary vicissitudes of the Company are instructive. They go to show once more that the decision of one Committee of Parliament is no indication of the state of mind of the next. One dictum of Sir Frederick Godson, the Chairman of the Committee considering the Bill, is well worth remembering. He declared (not once or twice) that too much reliance must not be placed upon parliamentary precedents in regard to decisions on matters of fact. He particularly objected to such a question as "exclusion" or "non-exclusion" being argued upon the ground of precedent. Every instance of the kind, he insisted, is to be dealt with on its merits; and this certainly seems to accord with the promptings of common sense.

The Indirect Effect of the Bermondsey Clause.

If the Bermondsey clause has no other effect—and it is rather to be believed that its direct effects will prove to be of great value to the community—it has already performed good service indirectly, by calling the attention of municipal economists to the subject of the relative incidence of local rates and of charges for public supplies. It has always been contended in these columns, that what are called the profits of municipal services to the community should be regarded as ear-marked for the purpose of reducing the charges, so that all such undertakings should never be more than self-supporting. For a very long time, those who took this view of the finance of municipal works of a remunerative order laboured under the disadvantage, for the purpose of argument, that they could only speak for gas supply and champion the cause of the consumer of gas against the ratepayers as a body. This difficulty has now been removed, however, by the extension of municipal trading to a good number of other fields, and notably to the actual working of tramways. It seems so natural at the present day for municipal corporations to work their own tramways, that one is apt to forget how recently the privilege was acquired by British local authorities. One result of the experiment has been to create a strong public opinion in favour of applying all surplusage of profit to the reduction of the fares; for the same reason—of the unfairness of making any other allocation of the money—which it is so difficult to make operative with local authorities owning

profitable gas-works. As regards tramway fares, that much-quoted individual the "man in the street" can perceive how unfair it is to keep up the fares with the object of showing a profit to be devoted to the nominal reduction of rates—the rates that are nevertheless always mounting higher. In the case of the vast multitude of those who use the tramcars a great deal, and live in small dwellings, the expense of the fares is a very much greater consideration than any possible benefit they could derive from a tramways subsidy in aid of rates. This is only an extreme and unmistakable illustration of the principle which should apply equally to the cases of the gas consumer and the user of electricity. The only safe and fair rule lies in making all such undertakings self-supporting, and no more. As a matter of fact, there are no "surplus" profits in trade when properly conducted, if sound business principles are observed. Capital and enterprise must be adequately remunerated, of course; but after this the prudent trader will put any overplus into his business, where it is likely to do most good. Exaggerated profits, or even the repute of them, are calculated to attract unwelcome competition, and are therefore better dispensed with.

Changes in the Petroleum Trade.

Various and sundry rumours have been circulating for some considerable time past respecting the mineral oil trade. The difficulty of forming a just opinion concerning the trend of events in this trade, proceeds from the absence of anything like reliable published information as to what is going on in connection with the various sources of supply. For instance, the world has been well dosed with statements to the effect that the Texas field was going to be a very big thing indeed. Some little time ago we ventured to repeat a report that "Spindle Top was giving out;" for which we were hotly attacked by certain interested parties. It now appears to be accepted, even by these parties, that Spindle Top has failed to justify the promise of its youth. The production has dwindled to insignificance; and the salt water has gained so much upon many of the wells that they are now abandoned for good. There are no ships upon the high seas with gas oil from Texas; nor has there been one for a long time, clearing foreign. The attempts that were renewed a year ago to create a market for oil fuel in this country have been checked by the increased cost of the commodity, just as of yore. It appears to be an ineradicable propensity of petroleum to jump up and down in price by as much as 50 per cent., which makes it awkward to deal in. A change in the trade that may mean a great deal to importers and their customers has been heralded in the announcement of a great "oil combine," under the auspices of the Lord Mayor of London (Sir Marcus Samuel), who is the principal proprietor of the Shell Transport and Trading Company. Indeed, he and his firm dominate the Company completely, and are responsible for its destinies. It is stated that the Company have now completed an amalgamation of certain Russian and Dutch East Indian producing interests, who will distribute their output under the name of the Asiatic Petroleum Company, of London. Originally it appeared that the combination had for its objects the sale of petroleum in the Far East, and of petroleum spirit in Europe; but the scheme now evolved does not exhibit any such limitations. It looks, at any rate, as if the Shell Company had turned away from Texas to seek compensation in the Old World from the disappointments of the New.

Mr. Tysoe's Travels.

Mr. J. Tysoe, the Engineer of the East Greenwich Works of the South Metropolitan Gas Company, who, as stated last week, has recently visited Brazil in connection with the attempted perpetuation of the corner in thorium, has favoured us with a most interesting account of his travels. This we are very glad to be able to publish to-day; feeling sure that it will afford pleasant reading for his professional brethren. Varied as are the contents of the "Journal" from time to time, it is not often that they include anything in the way of adventures abroad, for the labours of an engineer of a gas-works do not usually take him far from his own retort-house. The more worthy, therefore, to be chronicled are the travels undertaken by Mr. Tysoe, not only in the interests of the particular Company which he serves, but in those of the gas industry. With the success which attended his efforts to prevent the completion of a contract which was fraught with the greatest possible danger to everyone desiring the production of cheap incandescent mantles, our readers have already been made acquainted; now Mr. Tysoe relates how he accomplished it, the nature of his journey, and the interesting things which he saw. It is easy to imagine Mr. Tysoe's feelings while at the hotel at Guarapary—"where the sands come from." There is surely something peculiarly ironical in the fact of one whose whole time and attention are devoted to the provision of the best possible illuminant for the use of other people, being condemned to eat his own dinner by the light of a single candle! But we know that a prophet is without honour in his own country; and apparently monazite sand also has to seek farther afield than Guarapary for a proper appreciation of its virtues. Even at Victoria, the capital of the State in which the deposits exist (and "a beautiful place, viewed from a distance"), there has been no gas lighting for the past twenty years; the old works being now represented by some mournful ruins on the foreshore, which are extensively patronized by the vultures which constitute the local sanitary authorities.

For the Benefit of Sulphate of Ammonia.

There can be no doubt as to the beneficial influence that the Sulphate of Ammonia Committee are exercising on the demand for sulphate of ammonia in Great Britain. It must not be forgotten that the output of sulphate is constantly expanding; and unless the demand progresses proportionately, the result must be a falling away of the price obtainable. But we find this, that during the year ending June 30 last, there was a very fair appreciation in the market value of this commodity, notwithstanding the fact that the production must have been greater. For this happy condition of things, the propagation work of the Sulphate of Ammonia Committee should be credited with a considerable share. The report of the Executive, published elsewhere in this issue, while it does not make any definite statement on the subject, leaves no doubt as to the consumption being steadily on the increase among agriculturists in this country; and this is partly an effect of carrying light on the subject into those districts where sulphate was practically unknown before, but is now in almost general use. The competitions for the Committee's prizes are largely responsible for having brought about this result; and it is satisfactory to find from the report that these competitions are growing in favour. Ireland has been receiving a large amount of attention from the Committee, who are exhibiting for the second time at the Cork Exhibition this year, as well as, on this occasion, demonstrating with various crops on land that has been placed at their disposal. Mr. F. T. Cotton, of Dublin, and Mr. J. Magrath, of Cork, have been industrious in supervising the details connected with this enterprise in Ireland; and we hope their devotion will yield as large a measure of ultimate success as the crops that are being treated by sulphate of ammonia are yielding. There was no abatement last year in the general trials made under the auspices of the Committee; and literature was freely distributed throughout the kingdom. We cannot omit once more an appeal to the Gas Authorities who are not subscribers to this excellent institution, but who enjoy the fruits of the work, to remember that every subscriber adds to the strength of the Committee, and every subscription helps in the development of knowledge as to the fertilizing properties of sulphate of ammonia. It is this spread of knowledge that maintains, in face of an increasing output, the price of the article, in which all gas-works are more or less directly concerned.

Trade Union Conspiracy

A charge of conspiracy has been successfully brought home to a Trade Union, at the Manchester Assizes, in a case in which a master painter and decorator sought to recover damages from the National Amalgamated Society of House and Ship Painters and Decorators, for loss sustained by reason of their having conspired to induce certain workmen to break contracts which they had entered into with him. A "walking delegate" of the Union, named Lowe, was joined as co-defendant in the action. It was explained in the course of the hearing that, subject to the sanction of the Management Committee and the Executive Council, Lowe had full control in carrying out the Society's objects, one

of which was "to regulate the relations between workmen in the trade and their employers." In September, 1901, the plaintiff (Mr. James Carr) undertook work for a firm who had contracted with the Salford Tramways Committee; but for some reason with which he was not directly concerned, when his men started the job the "walking delegate" came forward and peremptorily ordered them to stop, which they did. It subsequently turned out that the plaintiff was merely being made a victim in some dispute which the Society had with the head contractors for the work! In the following January, however, the plaintiff took into his employ a non-union foreman; and this resulted in the men at his works being called out, with the knowledge of the local Secretary and the Executive Council of the Society. Not only were the Union men thus called out, but the defendants even went so far as to bribe others not belonging to the Society to leave Mr. Carr's employ. The persecution did not end here. The plaintiff after this entered into negotiation with a man who had contracted to do work for the Manchester Corporation; and Lowe, on hearing of it, went to the contractor and to the Chairman of the Tramways Committee, and told them it was his intention "to bring Mr. Carr down on his knees," as the Society had had trouble with him. He also stated that if they let any subcontract to the plaintiff, all his men would be called out. The plaintiff therefore lost the work. Still, however, it seemed that the defendants were not satisfied; for the plaintiff alleged that wherever he sought employment he was hounded down by the Society. People rejected his tenders so soon as they found out that, immediately the work was entered upon, his men were liable to be called out. He therefore claimed £2000 damages; and, in reply to a remark by the defendant's Counsel, that this was a big figure, the plaintiff, when in the witness-box, said: "I would not undergo the torture I have endured again for ten times the amount."

And the Penalty.

A more deliberate case of an attempt to ruin a man who chose to remain independent of the officials of a Trade Union it would be difficult to imagine; and it is therefore gratifying to find that, after a trial extending over two days, the Jury found that defendants maliciously, and with the intention of injuring the plaintiff, did conspire to induce men to leave his employ, and to prevent him from carrying on his trade—adding that "there was no excuse for their acts." They, however, decided that Lowe did not knowingly and for his own ends or the ends of the Society procure the plaintiff's workmen to break their contracts. The Jury assessed the damages at £322; and Mr. Commissioner Bray, K.C., granted an injunction restraining the Society from further acts of interference. Then, as if this were not bad enough for the defendants, their Counsel made matters look even worse. A stay of execution was asked for, and acceded to on condition that the damages were paid into Court. This, however, defendants' Counsel refused to agree to; remarking that if stay could not be granted without the condition named, he must withdraw his application, and leave the plaintiff to take his own course. "It was," he said, "doubtful even if the Society's funds could be got at for this purpose." It thus appears possible that Mr. Carr may have some difficulty in recovering his damages; but at any rate he has secured the injunction—an even more important matter for him.

The Growth of the Prepayment System.

Some striking figures regarding the rapidly increasing popularity, both in this country and abroad, of the prepayment system of gas supply were given by Dr. H. Aron in a paper which he read at last month's meeting of the German Association of Gas and Water Engineers. From these, it appears that prepayment meters have, until quite recently, made but very slow progress in Germany; only about 25 of the gas-works there having adopted them in 1900. Since then, however, this number has doubled; and Dr. Aron is of opinion that further great developments are pending in this direction. Berlin and Carlsruhe show fair progress in the extension of the system; but the statistics quoted with regard to other countries—England especially—indicate how much room still remains for improvement in Germany. In Great Britain last year over 25 per cent. of the total number of gas consumers were supplied through prepayment meters, as against about 18 per cent. the previous year. Taken individually, of course, there are many undertakings in England which are able to show much higher figures than these; there being no less than eighty cases (including the South Metropolitan Gas Company) in which more than 50 per cent. of the consumers are supplied on the prepayment system. As indicating that the rapid increase in the number of coin-freed meters in use is not due to the fact that service-pipes, boiling-rings, and burners are supplied with them, Dr. Aron points out that the German Continental Gas Company for a long time previously let apparatus of this kind on hire without experiencing the growth of business which has accompanied the introduction of prepayment installations. The many other advantages which the system offers are quite sufficient to account for its popularity among gas consumers.

Something They Do Better in Germany.

An attentive perusal of the instalment published to-day of the proceedings at the recent meeting of the German Association of Gas and Water Works Engineers, will reveal one respect at least in which the methods adopted by that organization are far and away in advance of anything that is done by kindred Associations this side. We almost hesitate to mention the matter, for Englishmen must by this time be getting tired of being told how much better things are managed in other countries. Sometimes, happily, consideration shows that the reasons given for placing our own countrymen behind any and every one else have very little (if any) foundation in fact. This, however, cannot be urged with regard to the matter to which we are now impelled to direct the attention of our readers. A glance at the reports of the various Technical Committees which were presented to the German Association will be sufficient to convince anyone of the great value to the two industries which the Society represents of the researches carried out on their behalf. Further scrutiny will reveal the means by which these Committees are enabled to undertake their various tasks. A sum sufficient to meet the anticipated outlay is asked for, and is straightway granted by the Association. Thus at the last meeting an amount of nearly £580 was placed at the disposal of the Committees during the ensuing twelve months; the objects for which the money was voted being of a widely varied but of an exceedingly useful character. For instance, £100 is to be spent on demonstrating the advantages of incandescent gas lighting, and £200 on the printing of statistics relating to a large number of German and Austrian Water-Works. Then again £35 (with power to exceed this sum if necessary) was granted to the Committee appointed to establish protective regulations in regard to electrolytic action on mains. In all, over £600 was given by the 49 subscribers to the fund for promoting scientific work; and among the gas-works which contributed, we are pleased to notice five of the stations of the Imperial Continental Gas Association. It may safely be assumed that the money thus invested by the German Association will be returned to the industries represented, along with a rate of interest far surpassing the dreams of even the most avaricious money lender. Surely, then, here is one thing which it must be admitted "they do better in Germany."

The Authority of Foremen—and its Responsibilities.

The necessity for a clear appreciation by foremen of gas and water companies of the extent of their authority in connection with the carrying out of work under their supervision, is exemplified in the case which came before the Court of Appeal last week, as reported in our "Legal Intelligence." The facts are simple. A row of new houses required a supply of gas and water, and the Rhymney and Aber Valleys Gas and Water Company were called upon by the builders to furnish it. The Company's Act provides that they shall not be bound to supply water unless each house has a separate service-pipe; but it was alleged that one of the Company's foremen gave permission for the use a single pipe for each pair of houses. When the time came for making the connection with the main, the Company declined to do it on the ground that their regulations, from which, they said, no deviation had been sanctioned, had not been complied with. Thereupon the builders made the connections themselves, and the Company severed them. The builders subsequently took proceedings to restrain the Company from preventing them restoring the connections; and Justice Phillimore granted an injunction,

with damages assessed by the Jury at £67. The Company appealed on the question of the competency of the plaintiffs to apply for an injunction instead of bringing an action for penalties for failure to supply. But it was contended that the plaintiffs could not sue in respect of non-supply if the service was not connected owing to an act of the Company; and it was urged that the injunction was granted with the very object of preventing the continuance of this condition of things. The Court unanimously decided to dismiss the appeal, with costs. The Master of the Rolls, in giving judgment, said it did not in the least matter whether or not the foreman had the authority attributed to him by the plaintiffs. The connections with the mains had been properly made, and in severing them the Company were guilty of a high-handed trespass for which they had rendered themselves liable to an action at common law. No statutory provision could be pointed to which ousted the plaintiffs' right to damages; and these the Jury had given them. As the wrong done was not one for which a penalty had been provided by statute, his Lordship did not think it necessary to consider whether or not the remedy by injunction was ousted. The supply of the six houses in question will not be a profitable piece of business for the Company; but the litigation to which it gave rise will not be without value if it emphasizes the necessity, not only in the case of the Company specially concerned, but of all others, for the exercise of caution, by foremen and similar subordinate officers, when giving orders in regard to their jobs. In the present case, there was a distinct departure from the Company's regulations; and whether this was allowed through ignorance or simply through inadvertence, the result has been to put all the parties concerned to considerable expense, which they might very well have been spared.

The Troubles of Municipal Finance.

A fortnight ago reference was made to the unfavourable terms secured by the Liverpool City Council for their latest loan, as compared with those which were obtainable in former times. It would seem, however, from some remarks made by the "Financial Times," that others are faring even worse than Liverpool, inasmuch as, in view of the recent over-supply of corporation loans, the leading dealers on the London Stock Exchange have decided not to underwrite any more of them at present. Such loans are, in fact, to be generally discouraged until there is more sign of a genuine market for them. This decision, says our contemporary, is hardly to be wondered at; for, to take as an example the Brighton Corporation issue of £600,000 just offered, it is reported that the underwriters were landed with about 80 per cent. of the amount guaranteed by them. In consequence of the determination come to, it is understood that several contemplated issues have been "hung up" for the time being. The state of matters thus revealed is just now particularly unfortunate for Nottingham; the City Council having held a special meeting last week, at which it was resolved to make a further issue of over £600,000 of 3 per cent. redeemable stock. It is evident that the inclination of investors to lend is nothing like keeping pace with the desire of municipalities to borrow; but at the same time it would, of course, be obviously unfair to throw the whole of the blame for the present condition of affairs on the municipalities. There is a glut in the market of gilt-edged securities generally. The "Financial Times," however, points out at least one advantage that should accrue from the existing state of things—namely, that it should give a decided check to municipal enterprise, because schemes which cannot be financed on favourable terms will have to be abandoned. This, it is added, should react favourably on private, or rather joint-stock, interests; and "for some weighty reasons, this would be no matter for regret." If the result should be as is here anticipated, many an overburdened taxpayer will have cause to thank the underwriters for having put some limit (at all events temporarily) to the exercise of the borrowing propensities of local authorities.

Differential Prices at Birmingham.

In connection with the proposal to reduce the price of gas which is to come before the Birmingham City Council to-day, some instructive figures have been prepared on the subject of differential rates according to the quantity consumed. The proposal of the Gas Committee is that the maximum price shall be lowered to 2s. 6d. per 1000 cubic feet; this rate being charged all consumers up to 50,000 cubic feet per quarter. In this class are included no less than 94 per cent. (over 80,000) of the total number of consumers, though the amount of gas taken is only 43 per cent. of the total quantity sold. The next price—2s. 3d. per 1000 cubic feet—embraces consumers of from 50,000 to 250,000 feet per quarter, and accounts for another 5 per cent. of the total number of consumers and 25 per cent. of the gas sold. After this come consumers of from 250,000 to 1,000,000 feet a quarter, who, though they constitute a very small proportion indeed of the consumers, take 20 per cent. of the gas manufactured, for which they will pay 2s. per 1000 cubic feet. Last of all, there are the consumers of over 1,000,000 feet a quarter, who, though constituting a still smaller percentage of the consumers, take about 12 per cent. of the total gas supplied; and they will pay 1s. 10d. per 1000 cubic feet. It is estimated that, on the revised scale, the average amount of the accounts of consumers charged at the maximum rate will be £3 13s. 6d. per annum; while that of the users of over 1,000,000 feet a quarter will be £599 8s. 9d. per annum. A study of these figures will make it pretty clear, even to the consumers at maximum rates, why the Birmingham Gas Committee feel able to supply gas to very large users—no matter for what purpose it may be required—at substantially lower prices than would be justified in their own case. A hundred and fifty small supplies must entail more expense in every way than one large one. There is the greater loss by leakage, the larger cost incurred for meters, pipes, connections, inspection, &c., and the vastly increased amount of clerical work involved. Then, again, the Committee point out that if large consumers were induced, by reason of high prices, to adopt producer gas, and to dispense with the Corporation supply, it must inevitably follow that the rate at which small consumers could be supplied would have to be increased, inasmuch as, even if the output were greatly diminished, there would be no saving on fixed charges. All this should, on reflection, completely reconcile the private consumer to the scale of charges, even though at first he might be inclined to think that the manufacturer was being unduly favoured. Not, however, that there is evidence of any feeling of discontent existing in Birmingham; for, in following a principle of differential rates according to the quantity of gas consumed, the Committee are merely continuing a policy that was adopted when the undertaking was acquired in 1875, and which has been gradually developed.

WATER AFFAIRS.

Further Observations on London Water.

In noticing last week the effect of the June floods on the quality of the London water supply, as revealed in the report of Dr. T. E. Thorpe, the chief of the Government Laboratory, to the Registrar-General, we had to record a falling off in the character of the water compared with that to which the consumers have for many years been accustomed. It was admittedly due to the prevalence of extraordinary conditions, with which the plant of the Water Companies—efficient in all normal circumstances—was inadequate to successfully cope. Everything considered, however, the article they supplied was not so inferior as might have been expected. We have quoted Dr. Thorpe's observations on this matter, and it is only fair to supplement them by extracts from the report submitted to the Official Water Examiner (Mr. Charles Perrin, M.Inst.C.E.) by Sir William Crookes and Professor Dewar. These distinguished chemists were bound to refer to the exceptional colour of the water, owing to the presence of vegetable matter in solution; but they testify that its filtration had been "adequately and effectively performed," as shown by the results of their bacteriological examinations of 585 samples. Naturally, the raw Thames water was highly charged with microbes—no less than 10,337 being contained in a cubic centimetre; but when it had passed into the clear-water wells, it contained, as the mean of 175 samples, no more than 42 microbes. In the corresponding month last year, the mean of 25 samples of the raw water was 4338 microbes; while the mean of 272 samples from the wells was 32. It

will thus be seen that, notwithstanding the great difference in the character of the raw waters, the effect of filtration was to bring them to pretty nearly the same standard of purity. Sir William Crookes and his colleague state that though the mean number of microbes in the filtered supply last month was higher than in May, the increment was not excessive, and was not distributed over the whole supply.

In connection with the foregoing observations, it may not be without interest to refer once more to the great rainfall of the past month and its effect on the bulk of water in the river. The actual quantity of rain measured at Oxford was 5·58 inches—a larger amount than has ever been recorded in the reports made to the Official Water Examiner on behalf of the Companies. But it fell on ten days only, and by far the greater portion between the 8th and 16th. None fell after the 19th. The average fall for June is 2·10 inches; so that there was an excess of 3·48 inches—bringing up the total for the first half of the year to 7·83 inches, or 72·4 per cent. on the average of 35 years. Up to May, the total excess was 49·9 per cent.; so that during June actually 22·5 per cent., or an amount approaching one-half of the previous excess of rain, fell in the valley of the Thames. In the 22 years' experience of Sir William Crookes and Professor Dewar, such a fall of rain is, they say, altogether exceptional. Its effect on the river is shown by the records kept by the Thames Conservancy of the daily flow of water over Teddington Weir. On the 8th ult., it was only 505 million gallons; but by the 16th it had increased to 4575 millions. On the 19th, it had gone up to 5281 millions; and though the heavy downpour was followed by perfectly dry weather, the flow on the 21st was 7174 million gallons—the highest figures reached. As the gaugings are all taken below the intakes of the Metropolitan Water Companies, they do not include the quantity of water abstracted by them. That their operations were very far from "depleting" the river is shown by the fact that from the 11th of June till the end of the month, no less than 89,270 million gallons of water flowed over the weir. It is much to be regretted—even the London County Council acknowledge it—that there are not more adequate means than those now in existence for storing some of this superabundant water for use in seasons when the clouds do not discharge their contents so liberally. But that the Companies' storage is as extensive as it is, is not due to any support they have received from Spring Gardens, but has been obtained in the face of persistent opposition from that quarter. The condition of the Thames last month, and even now, shows that there is plenty of water at our doors. All that is needed is a large enough "barrel" in which to store it.

British Association of Water-Works Engineers.

In pursuance of what has become their custom, the British Association of Water-Works Engineers held their annual meeting last week at the seat of the professional labours of their President, Mr. R. H. Swindlehurst, M.Inst.C.E. Bolton is typical of those large industrial centres of Lancashire to which honest hard work has brought prosperity and progress, the climax of which has not been reached in Bolton, judging from the restless activity which abounds everywhere. With the attainment of the present great success, many names are honourably associated, and not any with more lustre among those of contemporaries than that of Alderman John Miles, J.P., who, as the Chairman of the Corporation Gas Committee, and through the public interest he has taken in, and the mastery he has acquired over, the inner affairs of the gas industry, has obtained for himself, it is not too much to say, a unique position in the gas world. As the Mayor of Bolton, it fell to him—and he did it with all the grace and courtesy which he has at command—to be the host of the Association on this occasion. The generous manner in which he did this, both by hospitality and the expenditure of time, greatly lightened the work of the President, who, too, did no mean share in welcoming and entertaining those who had put him in the position of highest honour in their organization. It is true, as his Worship aptly put it, the President this year is not a man of words but deeds; and it is more to his work, tact in conducting the proceedings, and solicitude for the completeness of the arrangements for the meeting, than to any eloquence of tongue, that we are able to describe the meeting as an unalloyed success. The characteristic applied to the President by the Mayor was also abundantly proved by the condition of the water-supply works of which the Bolton people are the proud possessors. These works, like the other municipal undertakings of the town, are conducted on the same commercial principles, and with the same eye to making them a success from the point of view of profit, that the leaders of the borough apply to, and have in connection with, their own private concerns. The result is one which many other municipalities may envy, and would do well to emulate.

Apart from this aspect of the week's meeting, the proceedings will make a brilliant addition to the Transactions of the Association, for their technical quality is of a high order. The Presidential Address was pithy, and constructed in that epigrammatic style for which the President—not only among his professional colleagues, but among his friends in Bolton—has acquired some amount of fame. The address revealed, by comparison, the thriving position of the Association in its membership; but it is a pity there was not at the meeting a better relation between the attendance and the present actual strength of the organization. The investigation and recommendations of the Association of some time since in connection with the subject of Water Boards have in large part received justification by endorsement in the recent recommendations of the Royal Commission; and to this the President made allusion with considerable satisfaction. A further disclosure was the very practical views entertained by the President as to the training necessary for the making of a youth fit for the duties and responsibilities of a water-works engineer; and, speaking from the experience of his own disciplinary training in the shop, at the machine, and on the works, the President says, in a manner which seems to breathe out a distinct challenge: "No amount of lecturing will make a youth proficient in "practical work, and no accurate or useful knowledge of "the nature of materials can be gained otherwise than by "handling them." But he goes on to show that the training of an engineer does not stop with the ability to construct works and procure that which he is required to supply. It is a further incontrovertible essential that he must be trained to a due recognition of his responsibility to be able to prove that the money he is expending on his works will be a good investment for the community he is serving. The sections of the address dealing with the subjects of rainfall and the purification of water may be taken as the summary in these two directions of the results of the President's studies and mature experiences over a considerable period. With a beautiful conciseness which is worthy of close imitation, he states his case under both heads, and they will repay the careful consideration of readers. Though a good worker for the Association, and a never-failing attendant at the meetings, the members had on no occasion been brought into such close touch with the President's views on the topics dealt with; and they were pleasantly surprised with the number of points he managed to press into the address for them to reflect upon. An immobile exterior is clearly not always an index to the degree of activity within.

Upon the papers presented and discussed at the meeting, little need be said this week, as the few matters which may appear to call for comment will be dealt with simultaneously with their publication. The subject matter of the papers was varied, in all cases attractive, and consequently commanded considerable discussion. It is evident that greater attention is now being paid by the contributors of these written communications to their composition, and to a very large extent this must have relieved the Secretary (Mr. Percy Griffith) and the Publication Committee from the drudgery which attached to the revising and editing of some of the carelessly composed contributions that were submitted in the earlier years of the Association's career. And speaking of Mr. Griffith, it would ill become us to omit mention of his indefatigable exertions in connection with this meeting.

Prize Winners in the Last Examinations in Gas Manufacture.—We have received from the Superintendent of Technological Examinations of the City and Guilds of London Institute (Sir Philip Magnus) the names of the prize winners in the last examinations in "Gas Manufacture," a list of the successful candidates in which was given in the "Journal" for the 23rd ult. (p. 907). The first prize in the Honours Grade (£2 from the Salters' Company and the Institute's silver medal) was obtained by Mr. G. J. Clark; the second (£2 and a bronze medal), by Mr. Tom Brooke. In the Ordinary Grade, the first prize (£1 from the Salters' Company and the Institute's silver medal) was won by Mr. Fred Clough; the second (£1 and a bronze medal), by Mr. Edgar Foster; the third (a bronze medal), by Mr. P. Baldock Clark.

ESSAYS AND REVIEWS.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 253)

BAD as things have lately been on the Stock Exchange, they were worse last week. Every market, from Consols downwards, was weaker; and prices in general pretty well right through the list suffered shrinkage. The American Market was the darkest; and the gloom it spread was heightened by renewed apprehension concerning Chinese affairs. Business was, of course, on a very reduced scale owing to general reluctance to operate while things are so sensitive. The Money Market ruled easy for some days, and then began to harden a little—a state of affairs which is likely to last until this week is over. Business in the Gas Market was a good deal more abundant than it has been for some few weeks; but it was to a great extent confined to dealings in the leading Company. This was prompted by the dividend announcement—the first of those we looked forward to last week for reviving the Market—which had a good effect. The result of the half-year's working is that the Company will pay the same rate of dividend as they did for the previous half year, and will carry forward an undivided balance higher by some £50,000. This prospect caused the ordinary stock, which had been done "specially" as low as 82½ on Monday, to jump up to 86½, which it marked several times on Thursday and Friday; and the quotation was raised a couple of points. The secured issues, however, were not very firm; and buyers of the preference lowered their price a point. South Metropolitan was quiet (not half-a-dozen dealings were marked in the ordinary) but very strong; and the quotation rose two points. A few transactions in Commercials at moderate figures were marked. In the Suburban and Provincial group, there was hardly any business. The only change was a reduction of two points in Brentford debenture, without business being done, though the quotation did not strike one as being too high. Business in the Continental Companies was very quiet. Imperial and Union were weaker, and had to recede. Nothing in connection with the remoter undertakings calls for notice. The Water Companies had another quiet week; and prices again showed a tendency to slip down, by way of reaction after the large rise. Grand Junction and Southwark were the losers.

The daily operations were: Light business and easy prices ruled on Monday. Continental Union fell 2. In Water, Southwark fell 2. Tuesday was much the same. Gaslight preference fell ½. On Wednesday, the advance in Gaslight ordinary began with a rise of 1; but Brentford debenture fell 2. In Water, Southwark fell 1. Thursday was the most active day of the week; and prices were good. Gaslight ordinary rose 1, and South Metropolitan 2. In Water, Grand Junction and Southwark fell 2 each. Friday was quieter and unchanged. Saturday's prices were weaker. Continental Union fell 3, and Imperial 1.

ELECTRIC LIGHTING MEMORANDA.

Electricity-in-Bulk Speculation—An Abused Parliamentary Sanction—Exclusion Unfashionable—The Case of Bristol, and the Value of Power.

THERE is a pretty general agreement among those who have the best right to express an opinion on the subject, that the promotion of Electric Power Bills for carving up the United Kingdom into proprietary districts, ostensibly for convenience of electricity-in-bulk generation and sale, has been sadly overdone. This is a conclusion which many other people will find no difficulty in adopting when the facts become known to them. It is now some years since a Joint Committee of both Houses of Parliament—invited by the Board of Trade to consider the question of electric power schemes of the "Niagara" class, which did not come within the four corners of the Electric Lighting Acts—gave an opinion generally favourable to the institution of experiments of this character. The necessity for such a reference of the general question to a Joint Committee, proceeded from the consideration that otherwise the principle would have been contested afresh every time an electric power undertaking came for authority to take lands and break up roads in any part of the country. Unfortunately the favourable view taken by Parliament of the principle, especially as a means of escape from the localism of the Electric Lighting Acts, has been abused by speculators, who have since proceeded on the assumption that the expediency of any county or even more comprehensive electric power scheme was not to be impugned on the merits. Consequently, the land has been covered by speculations of the kind, most of them destitute of any substantial reason for existing beyond the circumstance that somebody was willing to pay all the expenses of procuring an Act, on the prospect of making something out of the promotion of the Company.

In the early days of this new development of electrical speculation, Parliamentary Committees were easily persuaded to accord exclusion of local government areas already served by an authorized electricity supply undertaking. The Yorkshire and Lancashire power schemes are the leading examples of this policy of protection of authorized undertakers by simple exclusion, and as such are always cited as precedents for similar proceedings at the present day. Latterly, however, the Committees have exhibited a marked dislike to perpetuate this practice. It can easily be argued that electricity-in-bulk supply must be commercially impracticable if all the best parts of the district are cut out. Besides, the only possible means of bringing the fresh breezes of trade competition into the close preserves of a municipality doing electricity supply, is by allowing a local electricity-in-bulk concern to show what it can do. Chiefly moved by these reasons, as it would appear, the Committees of the present session have definitely broken with the tradition of exclusion; and the leading case of the Bristol Corporation and the Somerset and District Electric Power Bill is in point. The Corporation wanted exclusion, and failed to get it under circumstances which must endue the precedent with great interest for all future promoters and opponents of similar Bills. Obviously, the strength of the case against exclusion, irrespective of the competitive aspect, is the consideration that what is good for any part of a district must be good for the whole. The Committees evidently thought that Bristol would be all the better for an independent supply of electric power, notwithstanding the claim advanced on behalf of the Corporation that they are doing their best to supply the demands of the public. This was denied; and the denial throws some light upon the conditions under which distributed electric power is expected to benefit an industrial community.

It is rather a curious reflection for us that we recently criticized the electricity supply undertaking of the above-named Corporation, and concluded that it is being carried on at a loss. Yet, it appears, the business is not being done cheaply enough, so far as the sale of current for power is concerned, to satisfy local requirements. The minimum price for the largest users is 1·2d. per unit.; and several manufacturers declared that this is too high. One of them named his own figure—saying that "unless electric power could be supplied at something between ½d. and ¾d. per unit, it would be of little use to him." This is what it amounts to, when vague observations as to the advantages of distributed electric power are tested by the actual requirements of power users. It remains to be seen whether even a power-in-bulk company can do business at this low figure; but there can be no question as to the *bona fides* of the manufacturer in stating his wants in this regard. Would-be suppliers of electric power may flatter themselves that they are doing the liberal and enterprising thing in offering such supply to large users at 1d. per unit, or thereabouts; but they are reckoning without the other possible party to the bargain.

Those corporations and companies who venture into the sale of electric power have yet a good deal to learn. They imagine that, by pricing their commodity at 1d. per unit, they will not only attract the large power user, but will make a profit out of him. Both eventualities are extremely doubtful. The only class of business in distributed power that has ever paid for doing is that of numerous small consumptions, very much diversified, and willing to pay a high rate of charge for the convenience. The large consumer of power, it seems to be overlooked, is also the one who wants it cheap—cheaper than he can supply himself with his requirements, as he has been accustomed to do. The price per unit does not matter one jot either to the small or the large consumer. The important consideration is only what he is asked to pay for the service done. It is the amount of the bill, not the figure upon which the charge is based, that concerns the consumer, especially the possible purchaser of power for use in business. The more corporations and companies fix their attention upon this aspect of the matter, to the exclusion of the mere price put upon the unit, the nearer they will be to agreeing with the manufacturer who informs them plainly that he cannot afford to pay more than ½d. per unit for his electric power.

"Die Chemische Industrie" for the current month contains an abstract of the report for 1902 of the Prussian factory inspectors. Among the appliances devised for the protection of the workmen, mention is made of a safety arrangement to be placed on storage tanks for benzol, which permits the escape of the vapours produced on warming, but prevents the benzol catching fire. It consists of a Woulff's bottle made of iron, which is filled with water, and is connected on one side with the benzol tank, and on the other with a vertical cylinder filled with metal sieves.

Among the many labourers in the cause of extended knowledge of the value of gas in culinary operations, few have been more zealous or more successful than Madame Alting-Mees, a lady whose name is well known to many of our readers. Her lectures have always proved attractive, especially upon the Continent, where her linguistic attainments have been specially valuable; and her audiences cannot fail to have profited by the many hints she gave them in regard to the preparation of food by the aid of that ever-ready auxiliary in the discharge of household duties—the gas-stove. For some little time Madame Alting-Mees has had to relinquish the work for which she is so singularly well fitted, in order to give her undivided attention to other matters. Now, however, she finds herself in a position to take it up again; and, as a preliminary, she is issuing the fourth edition of her little book "La Cuisine à Gaz," which, with its German companion, "Das Gas in der Küche," and the larger work in English, has been accorded a very appreciative reception indeed.

THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

DESCRIPTION PREPARED

BY

WALTER RALPH HERRING, M.INST.C.E., *Engineer.* *

ARTICLE XXVII.—Accompanied by Plate No. 27, illustrating the General Arrangement of Plant as at June 30, 1903.

The general plan accompanying the present article forms the conclusion of the contributions to the "JOURNAL" descriptive of the Granton works. The detailed account of the several parts will have already conveyed a fairly accurate impression of the works in their entirety, and little else remains to be said.

The conformation of the site was naturally good—presenting the form of a slightly irregular parallelogram, which was rendered still more shapeable by striking the eastern boundary on a line exactly at right angles to the northern boundary-line through the centre of two fields, in such a position as enabled a connection being made with the Caledonian Railway system crossing the south-east corner of the site. The principle which governed the general disposition of the respective parts was primarily that of railway access and the facilities for the manipulation of the ingoing and outgoing traffic; so that the future extension of the works could be as equally advantageously served as the first section without the traffic impeding the operations of any of the sections—seven of which must ultimately occupy the site.

As there is practically the same bulk of material to export from the works as is imported in the form of coal, there is consequently the same number of empty waggons required for the disposal of the material after the gas has been extracted from the coal. For this reason, therefore, the traffic that was feeding the retort-house was arranged to work in cycles. The loaded traffic approaches in one direction; and the empties passing forward come naturally into position for receiving the coke or refuse at the opposite end of the works. The operations in connection with this part, and their ultimate disposal, have no effect whatever upon the operations connected with the feeding of the respective retort-houses. It does not, of course, always happen that the complete cycle can be so conveniently worked; but this is immaterial to the purpose in view. The empties continue in the same cycle as when they were being moved as loaded waggons, and consequently they never impede the incoming coal traffic.

In preparing the plan for the "JOURNAL," only pipes connected with the plant have been shown—such as leading mains and syphon pipes. All drains, water-supply pipes, and gas-pipes for lighting purposes have been purposely omitted from the plan, in order to avoid the confusion of lines.

The railway-sidings are perhaps worthy of some special notice. They are shown in complete general arrangement, and may perhaps be referred to more specifically than they have yet been dealt with. As will be seen from the plate, the traffic approaches the works from two opposite directions—from the North British Railway system and the Granton Harbour on the one hand, and from the Caledonian Railway in an exactly opposite direction. This traffic is made to converge on to two leading sidings into which the Railway Companies' engines run and put the trains. Thereafter, the trains are manipulated by our own locomotives; the different classes of coal and other traffic being sorted out and backed into their respective sidings. It will be seen that the eight lines of railway sidings are traversed by two complete sets of "wriggle" curve points. The object of this is to enable the picking out of waggons from the middle or from the back of a train instead of having to shunt the full train's length in order to get at any particular waggon.

By no possible means can traffic enter or leave the works without passing over the weighbridges; and as the working of the traffic is in circuit, the empties must also pass out in a similar way through the "wriggle" points and curves. We have seriously transgressed railway formulæ as to the radius of curves, &c. The enormous amount of land that is sometimes wasted in private works by the introduction of the established railway radius curves of 10 chains, or 660 feet, is sometimes appalling. The necessity for laying a set of private goods sidings with rails arranged so that an express locomotive can take the curves, is not exactly a common-place necessity. I was emboldened to take this course by our experiences at the New Street Gas-Works, where our shallowest curve is only 22 feet radius, around which the ordinary 8-feet wheel-base waggon can be negotiated singly, slowly, and with care; while around another curve of 35 feet radius quite little train-loads of modern 9-feet wheel-base 16-ton waggons are passed. When I state that our shortest radius at the Granton works is 48 feet, others 60 feet, and the greatest 132 feet (the "wriggle" curves being 55 feet), it will be seen that I have considerably exceeded at Granton the diminutive curves at our New Street works, over which many hundreds of thousands of tons of traffic have been negotiated during past years. In the laying of the short-radius curves, and particularly with the "wriggle" curve crossings, great care has been taken to give the necessary amount of super-elevation to the outer rail; and by easing the gauge to the extent of $\frac{1}{2}$ to $\frac{3}{4}$ inch in breadth, no trouble is experienced with ordinary works' traffic running up to five miles an hour. In fact, we have no difficulty whatever with the working of the traffic over these lines. They take quite easily a 9-feet wheel-base waggon of modern type, which is now chartered up to 16 tons. The 40-ton bogie type of waggon will negotiate such curves even easier than those mentioned.

At the present time there are $4\frac{1}{2}$ miles of single-line railway on the works. Most of this was laid in the first instance in order to serve for constructional purposes; and its entire cost has already been recouped by our being able to deliver immediately on the spot all contractors' plant and appliances, as well as the goods and materials which formed the basis of their contracts—an item which was specifically mentioned in all specifications, as well as the provision of locomotive power and locomotive cranes for unloading and assisting in the erection of the plant. All of this, without exception, was within reach of our railways and locomotive cranes. Temporary branches were laid in many instances where the permanent lines were insufficient to afford the facilities which I could see would be worth while giving by laying down a line for the purpose. A circular line was also laid around the tank, so that the gasholder parts were taken direct from the waggons and placed into permanent position. I cannot too strongly emphasise the economy of such a practice. What with standard and narrow-gauge railways, locomotive cranes, and excavating grabs, ballast waggons, and concrete-mixing machines, we not only expedited the work, but saved much money, and, still more, have our plant ready for future operations.

Another endeavour has been to concentrate all the dirty work into one limited area. The whole of the coke and the breeze, also the ashes both from the producers and the boilers, all converge into one centre in the coke yard, leaving the remainder of the works comparatively clean and tidy, and unimpaired by the necessity for the transportation of such materials thereover.

The works being considerably exposed to view, an endeavour has also been made to represent them to the public in as pleasing a form as possible; and it is intended during the present autumn to do a large amount of planting of trees around the gasholder banks and the roadway boundary on the southern face.

Perhaps a notable feature is the close concentration of the plant into practically two buildings, and particularly the enclosing of so much of the plant within buildings—in fact, if it were not for the gasholder, a first glance would not disclose the place as a gas-works at all. Modern plant in the way of water-tube condensers and rotary washer scrubbers, has made it quite a simple matter to afford absolute protection to the plant at small cost; and the advantages of having absolute control of the temperatures is worth some little expenditure. Our British climate is notoriously changeable. The climate at Granton is even more so; winter temperatures prevailing in the shade, excepting during November and December and a few thunderstorms in July.

The 1000 tons a day carbonizing plant has already been sufficiently described as in one building with foul-main condenser in the roof.

It was at first intended to place the water-tube condensers after the exhausters and in the plant house; but an experience with a large tubular atmospheric condenser fixed in a similar position at our Leith works, caused me to pause and subsequently to alter my ideas. Although perhaps out of place, I will relate the circumstances, as they may have some bearing on the naphthalene question. A series of sixteen flat tubes 6 ft. by 1 ft. 6 in., each 25 feet long, with connecting branches of 24 inches in diameter, was erected over the side walls of a building from which the roof was purposely removed, and taking the gas after the exhausters at the Leith works—the maximum make of gas there being $3\frac{1}{2}$ millions per diem. On opening this condenser for cleaning in the subsequent spring, I was surprised to find a thick coating of from 3 to 6 inches of what at first sight appeared to be tarry naphthalene crystals. Believing naphthalene to be impossible when using 33 per cent. of cannel, I had a quantity removed; and, upon analysis, it turned out to contain 52·86 per cent. of ammonium carbonate, and the remainder tar and solid carbonaceous particles. The first year we removed 14 tons 17 cwt. from this condenser, and sold the material at the rate of £4 per ton. In each subsequent year, an equally large quantity was yielded, all of which was, however, put into our liquor-well in small quantities for the liquor to dissolve the same, as our contract was based on the principle of so much per ton of coal carbonized for tar and liquor.

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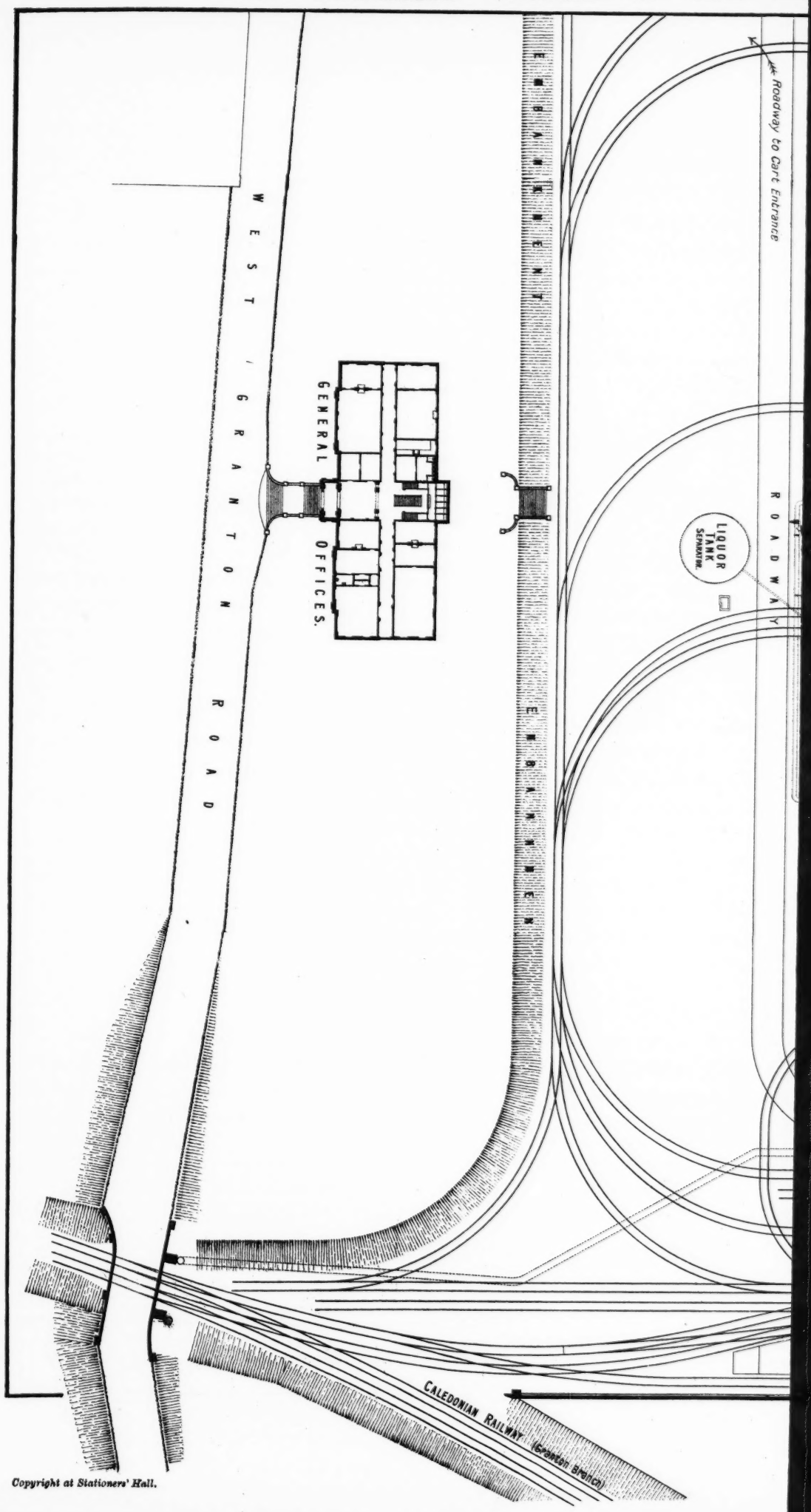
The Granton Works of the E



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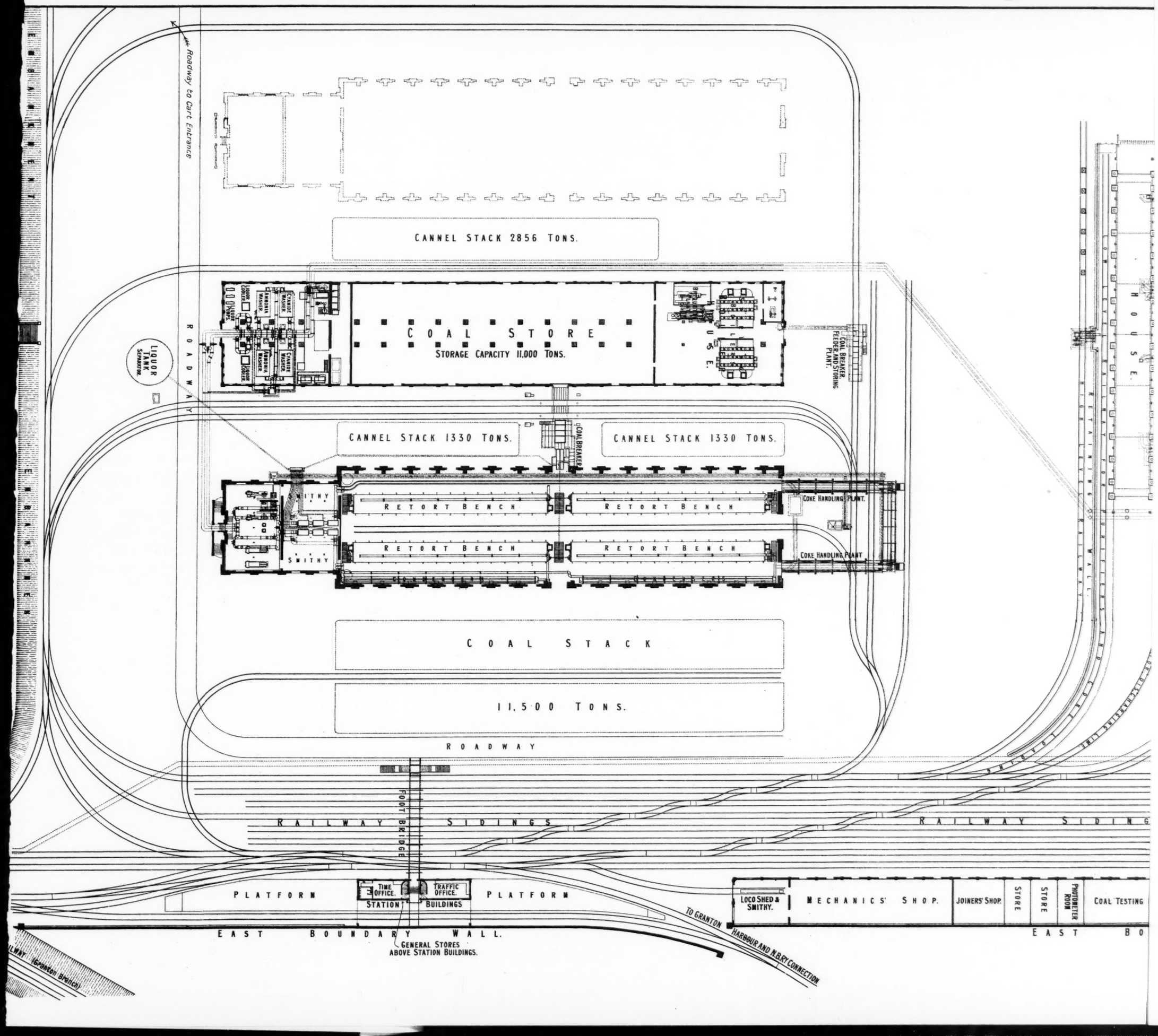
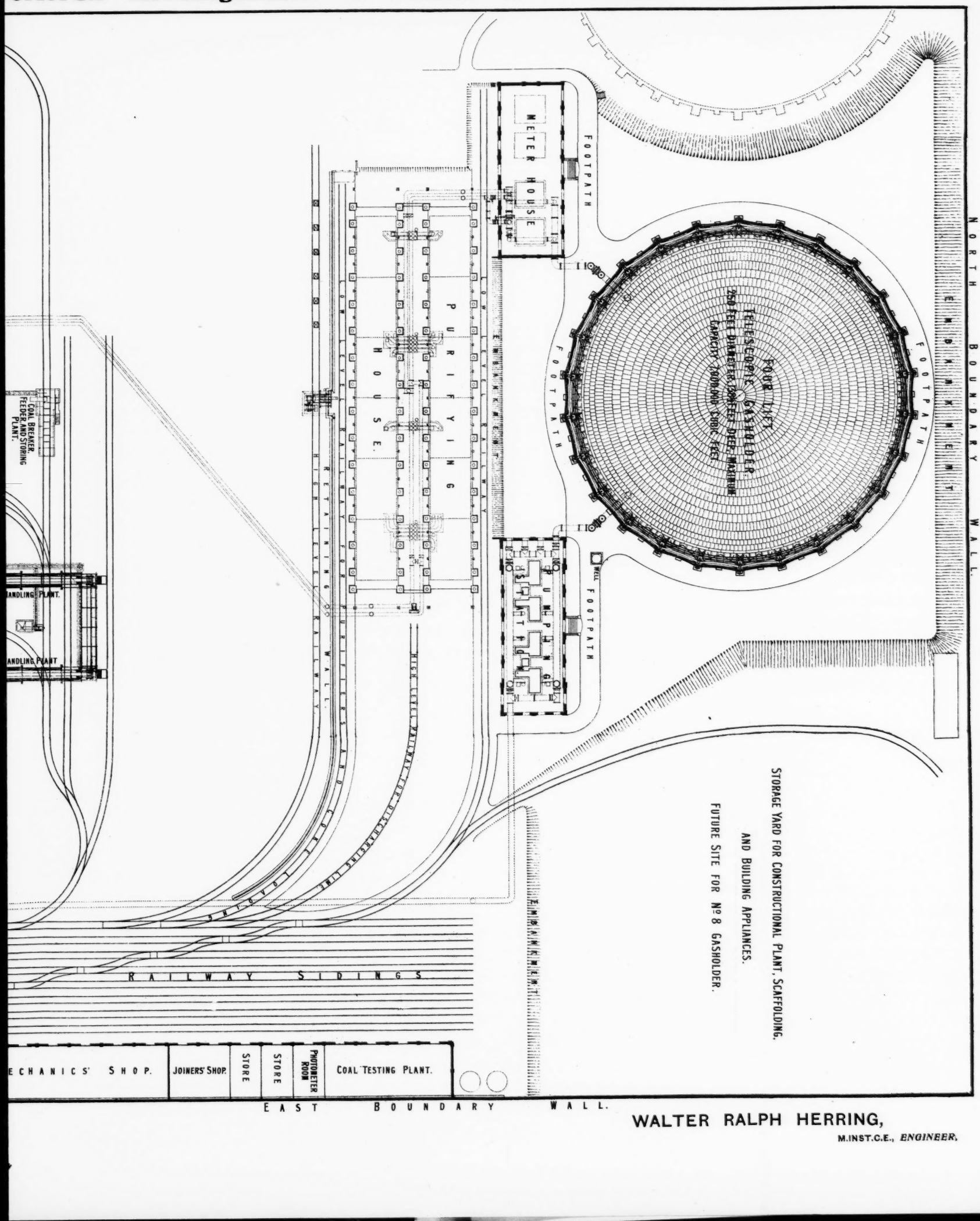
orks of the Edinburgh and Leith Gas Commissioners—The General Arrangement of



General Arrangement of Plant as at June 30, 1903.



WALTER RALPH HERRING,
M.INST.C.E., *ENGINEER.*

Such an experience naturally caused me to reconsider my ideas as to Granton; for while it was comparatively easy to clean out a tube measuring 6 ft. by 1 ft. 6 in., a nest of 1½ inch tubes in a water-chamber was quite another question. Upon looking more closely into the matter, I could come to no other conclusion than that my new condenser was also ideally designed to fulfil the purpose of a carbonate of ammonia crystallizing chamber. I believe it is a fact that carbonic acid and ammonia will not crystallize unless allowed to come to a comparative state of repose while under pressure. These elements were all present. The full resistance of the plant was concentrated in this chamber. The area of the gasway was 8·5 square feet, as compared with the 16-inch inlet and outlet main of 1·3 square feet; and although the carbonic acid and ammonia were much diluted with the coal gas, it does not appear to have prevented the successful combination. Some day I hope to prosecute this theme further; but at the moment I merely determined to place all my condensers before the exhausters and on the vacuum side. This change (rather late in the day) necessitated my confining the water-tube condensers in a somewhat restricted space beneath the gangway communicating between the exhauster-house and the charging stage of the retort-house, and on the ground floor beneath, with the two blacksmiths' shops on either side communicating direct with the retort-house.

The construction of an annexe to the southern end of the retort-house—within which is placed, on the ground floor, blacksmiths' shops for repairing the retort-house tools and a water-tube condenser house, and on the upper floor workmen's mess-rooms, bath-rooms, lavatories, &c.—is advantageous both for the men and also for their masters. The exhauster-house also forms part of this annexe, and, being so near its work, enables a better control of the operations to be maintained by the carbonizing foreman. The carbonizing book, into which the hourly record is entered by the foreman stoker, is kept in this house; and the hourly readings of the meter are telephoned from the meter-house for entry.

The exhausters are accommodated on a steel girder floor; all the connections being suspended from beneath. A complete set of gauges for indicating the pressures on the works is established in the exhauster-house, as well as an exactly similar set in the meter-house. The gauge-tubes are kept clear of stoppages by a system of steam cleansing, which can be operated without disconnecting the gauges. The condensation or solid matter accumulating within the pipes is forced back into the main or apparatus to which the pipes are attached. The same gauge chest is also fitted with 24-hour recording gauges, for registering the steam and the hydraulic pressures; also apparatus for registering the variations in the back-pressure at the outlet of the gas-exhauster, as well as the vacuum recorders for the retort-house.

Beneath the exhauster-house the machinery room contains the whole source of power for driving the coal breakers, elevators, and conveyors, as well as the coke conveyors, screening, and storing plant. One line shaft communicates with the whole installation, and extends altogether about 600 feet from the engines.

At the outset, I considered very carefully the wisdom of such a scheme. My object was to avoid placing engines all over the works, and little buildings to contain and protect them—to say nothing about the economy of running one high-power engine instead of several small units. The simile that presented itself to me was that, if an ocean-going ship could conduct herself properly by depending upon one main source of power, the Granton works could also be made to do so as regards its retort-house work complete; and I have no reason to regret the arrangements that have been put down.

The plant-house forms part of the coal-store block. It contains the Pelouze and Audouin condensers, the coolers for reducing the temperature of the hydraulic main and foul main condenser liquor before it is allowed to enter the condenser part of the rotary scrubbers, the ammonia scrubbers and cyanide scrubbers, as well as the plant for manipulating the cyanide solutions. The mains in this building are entirely above floor; iron gangways communicating to all parts of the apparatus where the operatives require to go.

At the opposite end of this block of buildings, the steam generating plant, consisting of tubular boilers of the Stirling type, fired by producer gas, are established. The coke dust briquette manufacturing plant is also accommodated at this end, as well as the apparatus for unloading, elevating, and automatically filling the soft-coal store. The coke yard and appliances for handling the coke and ashes is situated between the north end of the retort-house and the coal-store block and the south side of the purifier-house. Apart from the storage of about one night's production of coke in the storage hoppers in connection with the coke-handling plant, no permanent provision has been made for putting coke to reserve stock. During the past winter, we have temporarily worked with a steam-crane and a 2-foot narrow-gauge railway, piling the coke to a total height of 20 feet, in reserve for our summer customers, who are mostly situated on the Baltic, and who can only get their supplies when the Baltic is free from ice. The 2-foot gauge railway for removing ashes from the retort-house and also the boilers, as well as for the transportation of breeze to the briquette plant and the fuel to the boilers, are all made to converge and communicate in the coke-yard—delivering the ashes to the ash-elevator for loading the waggons and the other materials to their respective places. A small-gauge locomotive is employed for manipulating these waggons.

The position of the purifiers—as will be seen from the plan—is far removed from the retort-house operations. It is on a lower level than the coke-yard, and has railways communicating on either side. One of these railways on the low level is also utilized for loading coke from the coke-yard stock.

The meter-house and the pumping-station are placed a little to the north, and at either end of the present purifying-house. The meter-house itself is sufficient to contain meters for an additional section of works; the pumping-station is also capable of holding double the amount of plant that at present exists within it.

The gasholder occupies a site immediately to the south of our northern boundary.

The workshops on the eastern boundary are fitted with every appliance necessary in the way of smiths' hearths, power hammers, punching and shearing machines, lathes, &c.—such as will enable us to do all our own repairs of a general character that cannot be easily contracted for. The same block also contains the coal-testing plant, joiners' shop, paint stores, &c., necessary for works of this character.

A large stock of cannel is accommodated in the open yard. This is enclosed within permanent walls built of cannel itself; the interior stock being removed without interfering with these walls—the walls themselves being only taken down as a last resource. They have been built by tradesmen, and have all the appearance of dry rubble walling, and make a very neat enclosure for the contained stock. Some of our common coal is also of such a character as to make it quite safe to stack in the open yard. Apart from this, there is accommodation for some 12,000 to 15,000 tons of soft coal in the coal-store. The workmen's platform, traffic, and time offices are also situated on the eastern boundary. The arrangements are such that the men upon leaving the train pass through turnstiles, and must use the footbridge crossing the railway sidings—a precaution which in these days of Workmen's Compensation Acts is necessary. The men, likewise on returning from the works to the station, cannot check their time unless they get access to the apparatus *viâ* the footbridge above the station platform. Above the offices mentioned and covering the railway (also forming a covered platform) are the general stores, which communicate on a level with the footbridge. Trap-doors in the floor of the store enable the unloading of waggons from beneath; and a hand travelling crane, running on rails upon the upper flanges of the bridge-girders, enables weighty articles to be transported from the store and lowered over the end of the bridge to the yard beneath.

The general offices on the southern boundary have not yet been commenced, although it is hoped to make a start with this part of the work early next spring.

Having now reached the end of this instructive series of descriptive articles, so far as the gas-works themselves are concerned (the chemical plant may possibly be treated separately), we should like to acknowledge, apart from Mr. Herring's personal labour, of which recognition is elsewhere made this week, the great interest that has been taken by his staff in the preparation of the drawings and the perfection of the work entrusted to them. At the same time the excellence of the work of the lithographers—Messrs. Sprague and Co., of 4 and 5, East Harding Street—should be mentioned. They have taken such care in the production of the plates, and shown such intelligent appreciation of instructions and requirements, that there has not been ground for a single complaint; and this has considerably lightened our own share in this particular publication.—Ed. J.G.L.

Action of Water on Asphalte Pavements.—In the course of a paper on "Testing Bitumens for Paving Purposes," read before the American Society for Testing Materials, Mr. A. W. Dow dealt with the above subject. He said the action of water on asphalte pavements had, in the past, received little consideration from engineers. The question was very important, and the asphalte should be examined to determine whether or not it was attacked by water or moist air. There were many failures resulting from this action which had been attributed to other causes in the past; and a more thorough study of the subject was much to be desired. A simple method to ascertain the rapidity of the action of water was to coat a piece of glass with the asphalte paving cement, and partly immerse it in water. The coating should be examined at intervals, and the time noted when the first discoloration or action was observed on the surface of the sample. He added that another method sometimes used was to mould two 1-inch cubes of the paving mixture under a fixed pressure. This mixture was made with a standard sand, and the same amount of bitumen used each time. One cube was immersed in water, while the other was kept in air. These cubes were examined at the end of a month or two, and any increase in the volume or softening of the one in water over the one kept in air was noted.

A GERMAN INSTALLATION OF WEST'S RETORT-STOKING MACHINERY.

Reconstruction of the Crefeld Gas-Works.

THE Association of Gas, Water, and Electrical Engineers of the Rhine Provinces and Westphalia held their spring meeting at Crefeld on the 22nd of May; and the President—Herr Salzenberg—availed himself of the opportunity to give a detailed account of the extensions which have taken place since 1896 at the gas-works of which he is Manager. The works were visited by those attending the meeting, and much interest was shown in the complete installation of West's stoking machinery, which was exhaustively described by Herr Salzenberg.* In order to place before readers of the "JOURNAL" a picture of the conditions which this installation was called upon to fulfil, and to indicate in an authoritative manner the success which has attended its working, we propose in the sequel to give an account of it from the material provided in the address of Herr Salzenberg, which incidentally introduces other matter of considerable interest to English as well as to German gas engineers. The subject of the reconstruction of his works was also brought forward by Herr Salzenberg in a paper read by him at the meeting of the German Association of Gas and Water Engineers at Zurich from the 24th to the 26th ult. In substance, it was identical with the address above referred to; but he brought up to date the results of the working of West's machinery. These and some later figures which he has kindly supplied have been embodied in the results given below.

The two gas-works existing in Crefeld in 1896 passed in that year out of the hands of a private firm into those of the Municipality. Each of the works had a productive capacity of about 124 million cubic feet per annum; but as the consumption was growing very rapidly, it was decided to carry out large extensions at the No. 2 works. These works were more readily capable of extension than the No. 1. works. Fig. 1 is a plan of them as they were in July, 1896, prior to reconstruction. The old benches of direct-fired retorts, consuming coke amounting to 30 per cent. of the weight of coal carbonized, were to be taken out, and four benches of gas-fired settings, each with a productive capacity of 620,000 cubic feet per diem, were to be erected in the three old retort-houses and one new house. If the retorts were charged five instead of four times in the 24 hours, their output would be increased to a total of 3,070,000 cubic feet per diem, or 620 millions per annum. Actually, the last of the four benches was not completed until the beginning of last spring; but there are now in all 288 retorts, each taking a charge of 460 to 465 lbs. of coal. They are worked by means of drawing and charging machines on West's system, which, as will be shown more clearly later, perform their work with ease. The quantity of coke used for heating the retorts has fallen from nearly 32 per cent. in 1896, when direct firing was in vogue, to 10 to 12 per cent. in the last three years. The retorts are of unusual section; being ⌂ shaped, 23½ in. by 15¾ in., and with an effective length of 9 ft. 10 in. The retort-house is shown in plan in fig. 3.

In 1897 a plant was started for working up ammoniacal liquor corresponding to a make of 635 million cubic feet of gas per annum. Either concentrated gas liquor or sulphate of ammonia can be produced. Prior to 1897, the liquor had been sold in its crude state, and fetched in 1896 only about £586, whereas in each of the last two years over £3000 has been obtained for the concentrated liquor. The building and plant cost only about £1600.

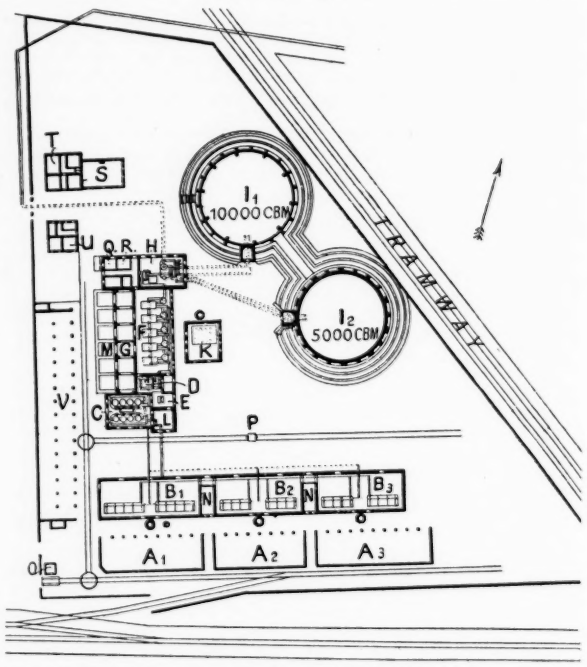


FIG. 1.—PLAN OF THE CREFELD GAS-WORKS (1896), BEFORE THE RECONSTRUCTION.

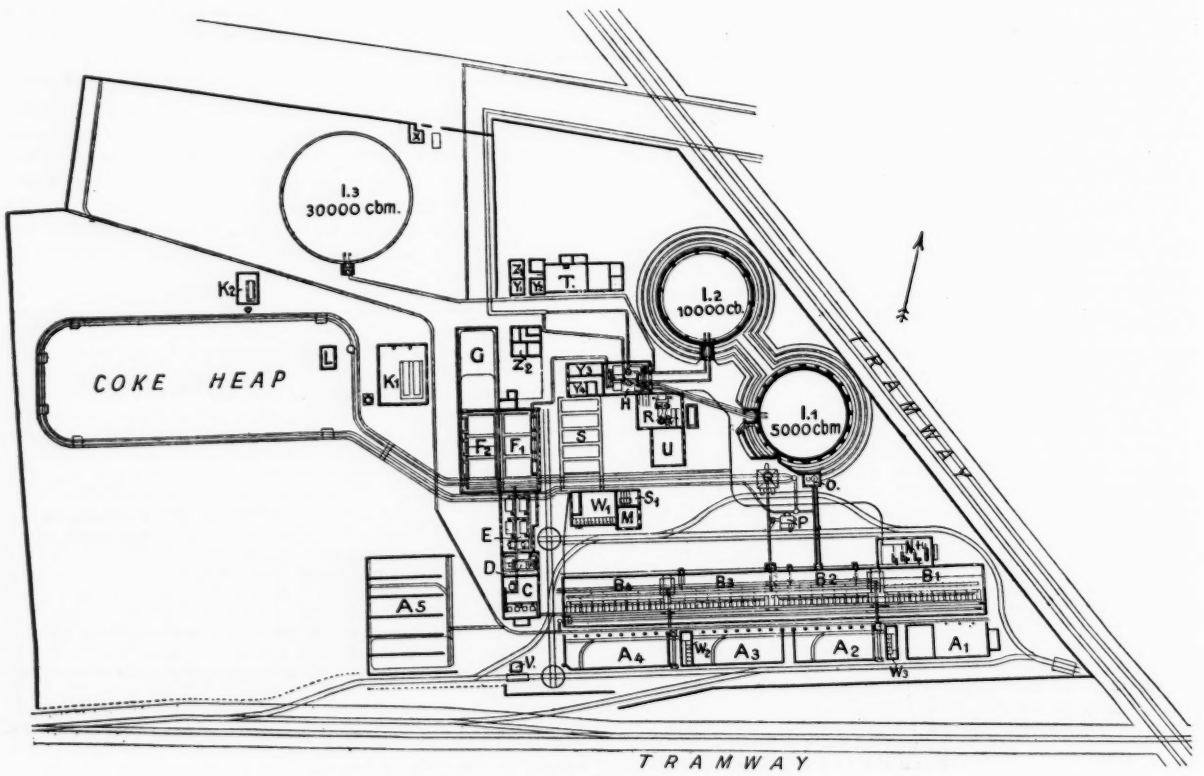


FIG. 2.—THE RECONSTRUCTED WORKS AS AT APRIL 1, 1903.

* An article on the gas supply of Crefeld appeared in the "JOURNAL" for Jan. 2, 1900; and the introduction of West's machinery was noticed in the number for Oct. 21 last.

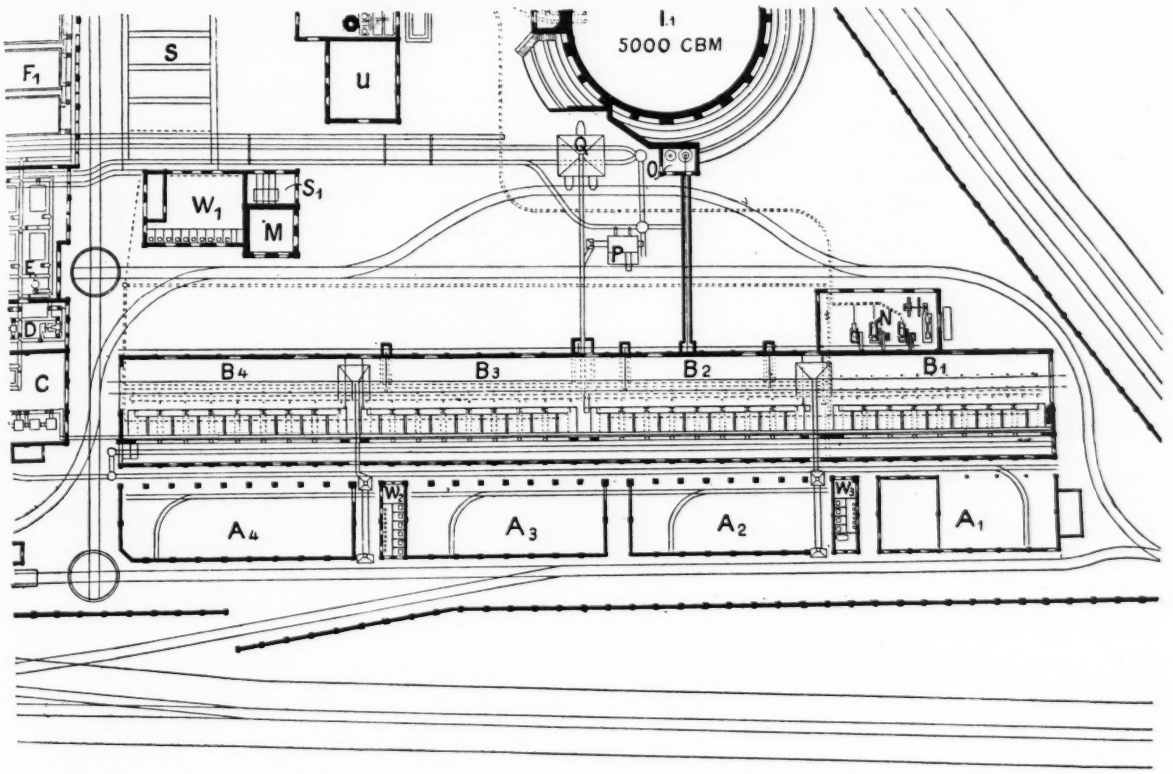


FIG. 3.—PLAN OF THE RETORT-HOUSE AND ITS SURROUNDINGS.

In 1897 also there were erected at the works a new exhauster, station meter, laboratory, and photometer room; while in 1898 two exhausters were put in in room D of fig. 1, so as to bring the capacity of the exhausting plant up to the maximum output of the works. New purifying plant for 1,235,000 cubic feet per diem was put down in 1898, on a site which had previously been occupied by a portion of a coke-shed, marked V in fig. 1. This plant is shown at F1 in the plan of the reconstructed works (fig. 2). Another portion of the coke-shed site was taken ultimately for the new washer-house (E, fig. 2), but was provisionally used as a revivifying-floor. The remaining portion was taken for a condenser house (C, fig. 2), with feathered condensers capable of dealing with 1,235,000 cubic feet of gas per diem, which now serve as preliminary atmospheric condensers, and are not sprinkled with water. Previously, in room C in the original plan (fig. 1), there had been only scrubbers with perforated plates, serving for both condensing and scrubbing the gas. Coal-sheds were removed from the No. 1 works, which were to be pulled down for the erection of electricity works, and were re-erected on the No. 2 works, at A5, in fig. 2. In 1898 also a new weighing-machine for 15-ton coal-trucks, a new railway connection with the Crefeld Railway, a new coke-breaker (P, fig. 2), and low-pressure steam-heating apparatus for the buildings on the works, were put down. Between 1899 and 1901, a Reuter condenser, capable of dealing with 2,470,000 cubic feet of gas per diem, was installed (in room C, fig. 2), while in room D, two exhausters for the same capacity, and driven directly from the steam-engine, were put in, along with a Pelouze and Audouin tar extractor, an impact washer, two naphthalene and cyanogen washers, two "Standard" ammonia washers—all of the same capacity, in an engine-room erected on the site of the former coal-sheds, which were used intermittently as revivifying-floors.

At the same time, bath-rooms and lavatories were installed at W1 and W2 (fig. 2) for the men employed in the shops and in the retort-houses respectively. Apparatus for admitting 2 per cent. of air to the gas was also installed between the hydraulic main and the first condenser, and not (as at Dessau and elsewhere) after the naphthalene and cyanogen washer. This apparatus has proved very satisfactory in relieving the labour of changing the purifiers. On Nov. 2, 1901, the old purifying plant (F, fig. 1), exhauster-house (D), and engine-room (E), and revivifying shed (G) were completely burnt out. But, fortunately, the erection of the new plant, including the exhausters in the houses D and E, fig. 2, was practically completed; and in five days, by dint of working day and night, it was brought into full use, and the supply of gas was thus kept up, despite the fire, which happily only destroyed the oldest and least serviceable plant. A new boiler-house (K1, fig. 2), with two Lancashire boilers, provided with Perret grates for the consumption of coke breeze, had been erected about this time, as also a new gasholder of 1,050,000 cubic feet capacity (J3, fig. 2). A small Cornish boiler in a house K2, fig. 2, was provided for the steam-heating of the water in the tank and cups of this holder. A well was sunk, and a pumping-station (L) provided, with the result that the cost of water for quenching was reduced from £37 to £3 10s. a quarter. A station meter was transferred from the old works, and was used for measuring the fuel gas required for operating the mechanical conveying plant. In the spring of 1902 also the second set of purifiers, marked F2 in fig. 2, was put down on ground which had previously been used as revivifying-floors for the first set of purifiers F1. The original scrubbing plant in the house C in fig. 1 was taken out, and the house reconstructed and formed into bath-rooms and lavatories on the ground floor, while a canteen was established on the upper floor. Finally, a new revivifying-shed

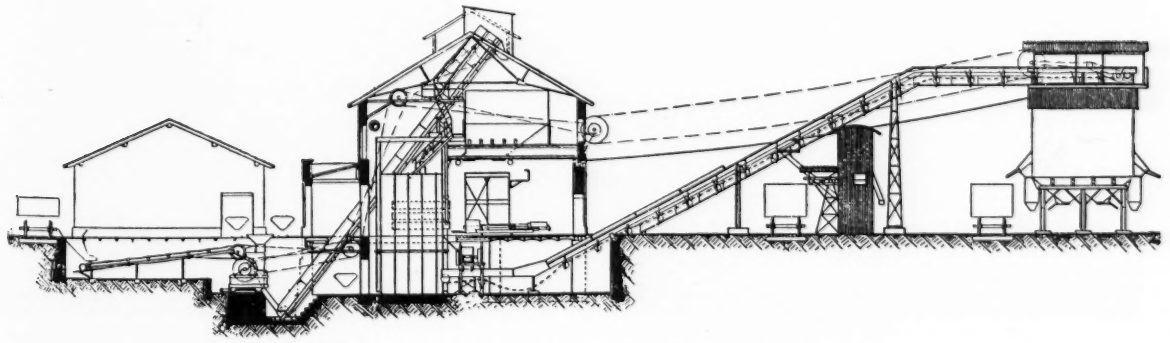


FIG. 4.—SECTION THROUGH THE RETORT-HOUSE, COAL STORE, &c.

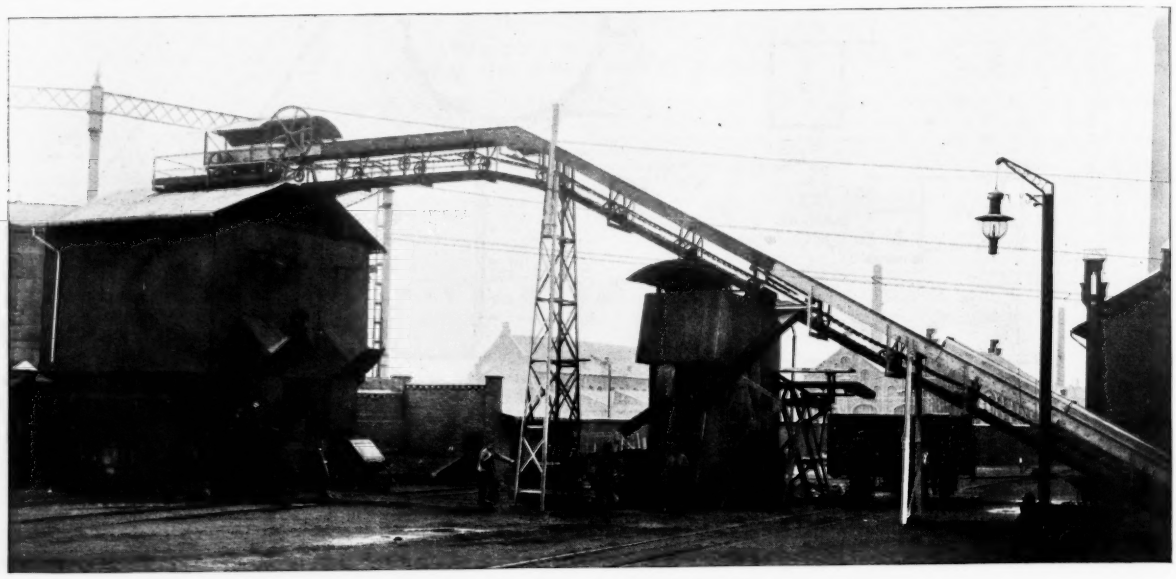


FIG. 5.—THE COKE CONVEYORS, BREAKERS, AND ELEVATORS.

(G, fig. 2) was provided for dealing provisionally with the oxide from both sets of purifiers, F1 and F2. The handling of the oxide for revivification had, however, been greatly reduced by the introduction of continuous revivification *in situ* through the admission of air to the purifying vessels, as already mentioned.

Prussian blue was recovered by the new method of working in the form of cyanogen sludge, consisting of ammonium ferrocyanide with about 12 per cent. of blue and 7 per cent. of ammonia. The spent oxide, in virtue of its contained sulphur amounting to about 50 per cent., was still saleable, though at lower prices than when the cyanogen passed into the purifiers. Later it is intended to work up the cyanogen sludge to prussian blue cake on the works, so that the ammonia in the sludge may be recovered as sulphate, because it appears to Herr Salzenberg that the gas-works will thus obtain a better return for the ammonia than from the firms who purchase the sludge.

In 1900 a new 20-inch main was laid in a circle round the town, as well as a 40-inch transverse connection, which with the 20-inch main portioned the town into two semicircles. As soon as these mains were brought into use, the unaccounted-for gas was reduced by more than 3 per cent., and the necessary evening distributing pressure went down from $2\frac{3}{4}$ to $1\frac{3}{4}$ inches. In 1900, the No. 1 works ceased to be a manufacturing station, and the three small gasholders were thereafter used only in connection with the No. 2 works. The latter works as shown in plan in fig. 2 are now equipped for an output of nearly $2\frac{1}{2}$ million cubic feet a day. A scheme has already been drawn up for doubling the capacity of these works, and some particulars of it may next be given.

The two purifying-houses F1 and F2 will be supplemented by the erection of two somewhat larger ones, having a joint capacity of 3,500,000 cubic feet per diem, on the ground to the north now partly used as a revivifying space G, and partly occupied by the porter's house *Z*2. The revivifying-floor will then be arranged underneath the purifiers. Or, as an alternative scheme—in the event of it being found that Jager's grids do in fact double the capacity of purifying vessels—no extension of the purifiers will be made, but a second revivifying shed will be erected alongside the present one G. The ground to the west of the present works is available for extensions, and would suffice to increase the productive capacity by 3,500,000 cubic feet a day; thus bringing the possible annual output in the far future to nearly 1200 million cubic feet per annum. For this extension, in addition to the enlargement of the purifying plant already referred to, it would be necessary to put down condensers, exhausters, and washers to deal with $3\frac{1}{2}$ million cubic feet per day alongside the present installations. Coal-stores and retort-houses would be erected to the west of the existing works, after pulling down the present coal-shed, shown at A5, fig. 2. A telescopic holder for $1\frac{3}{4}$ million cubic feet would be erected in the north-west corner of the works, together with a governor-house. The present arrangement of the works has been planned with a view to facilitating these further extensions when they become necessary.

But although in 1902 the works were adequate to make the

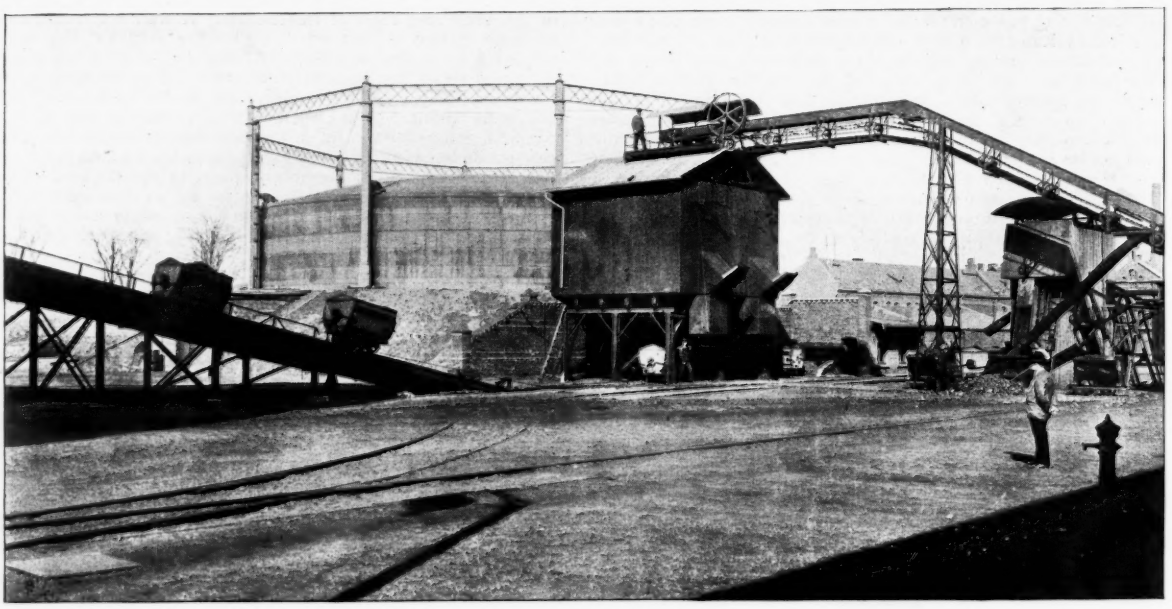


FIG. 6.—THE COKE TRAMWAY.

quantity of gas required, there was nevertheless much at fault in the methods of handling the materials; and want of mechanical conveying plant was reflected in the pay-sheets. The wages, apart from items booked under the head of "repairs," amounted to between 5½d. and 5¾d. per 1000 cubic feet of gas made. The incentive to modernize the prevailing antediluvian working conditions came suddenly in January, 1902, when labour difficulties arose, which culminated in the Municipality agreeing, on the 7th of April, to the system of eight-hour shifts. The Gas Committee appealed to Herr Salzenberg for his advice on the labour question; and, as a result, it was decided to adopt drawing and charging machines. He visited many Swiss, German, French, and English works, and then recommended his Committee to instal West's stoking machinery, driven by compressed air at 3½ to 4½ atmospheres pressure. The driving is accomplished by means of a special compressor, thrown in and out of action automatically. It comes into operation when the pressure reaches a minimum of 60 lbs. to the square inch (say 4·1 atmospheres), and is thrown out again automatically when a maximum pressure of 65 lbs. to the square inch (say 4·4 atmospheres) is obtained. The details of this installation will be referred to after mention has been made of the conveying plant which appeared to Herr Salzenberg to be required.

The plant just referred to comprised: (1) Two band conveyors, on which the coal could be directly thrown from the waggons; the bands being 24 inches wide, and capable of conveying 60 tons of coal per hour. (2) Two coal-breakers of the same capacity into which the band conveyors discharge the coal. (3) Two bucket elevators, 65½ feet high, also of the same capacity, to which the coal passes from the breakers. These elevators have wrought-iron guides for the chains, which have steel bolts. (4) Two overhead coal reservoirs, of 130 tons capacity together, into which the bucket elevators deliver the coal. (5) Two slides on these reservoirs, by which the coal passes to the secondary receivers on the charging-machines, each of which receivers hold supwards of 2 tons of coal, or sufficient to charge 10 retorts. (6) Four De Brouwer conveying troughs to receive the coke as it is drawn by the machines from the retorts. These troughs are in the basement in front of the benches, and the coke passes to them down inclined plates which serve to lessen the amount of dust formed by the fall. (7) Each of these troughs is provided with hand sprinklers as well as automatic quenching apparatus. Trough No. 1 discharges into trough No. 2, and No. 4, which runs in the opposite direction to these, discharges into No. 3. Each trough can be moved in or out independently. (8) A transverse conveying trough, into which troughs Nos. 2 and 3 discharge the

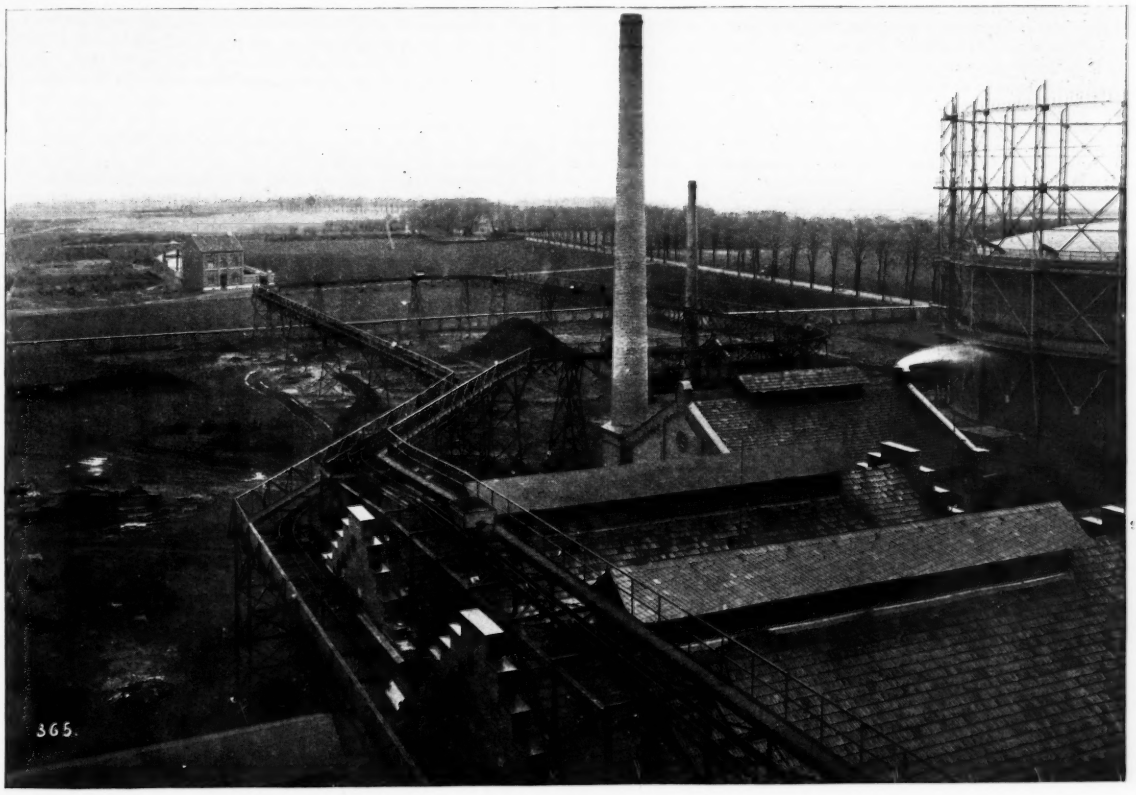


Fig. 7.—A Birds'-Eye View of the Tramway to the Coke Heap.

whole of the coke from the four longitudinal troughs. This trough slopes upwards, and conveys the coke as required, either to a coke-breaker, the inlets to which are opened or closed by means of special slides, or to a storage vessel, capable of holding a whole winter night's production of 80 tons. From this vessel the coke can be taken, as described below, to the coal-breaker or elsewhere the next day. By this means, the coke is never discharged at night on to the ground, to be picked up again by day. (9) An overhead coke tramway, which spans a number of the buildings on the works, and is capable, working 1½ hours a day, of conveying to the storage-ground to the west of the works (fig 2) all the coke which has not passed into the breaker, or been otherwise taken out by day from the large coke-storage vessel. The latter is thus every evening made ready for receiving the night's production, while the coke on the storage-ground is available for retailing. This overhead coke tramway is 200 yards long, and forms a loop. (10) It is equipped with Hunt's waggons, each of about 35 cubic feet capacity, which run along the line over the buildings at a height of about 27 feet. They are coupled and uncoupled automatically by means of an endless wire rope; and the gradients of the line are suitably arranged for facilitating the return of the empty waggons. This coke tramway is shown in figs. 6 and 7; while the disposition of the coal and other coke conveyors, breakers, and elevators is shown in figs. 4 and 5. Hunt's waggons are discharged where required by a striking mechanism which releases the side flap of the waggon (see fig. 8).

The description or size of the coke or breeze with which each waggon on the overhead tramway is loaded is indicated to the man at the discharging end of the line by means of different coloured discs; and he thus knows where to discharge each waggon. The breeze is shot at once in the boiler-house, and the coke, which has been sorted into three sizes, is stored in different places ready for sale locally. In order to relieve the coke-breakers, provision is being made for a preliminary screening and sorting of the coke as it enters the storage vessel, and before it passes to the breaker. Partitions in the vessel will keep the four different sizes apart, so that any desired variety may be taken from the vessel as required. In this manner, much of the coke will be dealt with by separation only, and without preliminary breaking. The inclines on the coke tramway line are calculated so that in still weather the empty waggons will run and couple up automatically. When there is a strong wind ahead or in the rear of the returning waggons, it is necessary to have a second man in readiness to give a shove to, or hold back, the waggons. But as this work occupies only a short time each day, the expenditure of labour is small and negligible, compared with the expenditure of power which would be required if the waggons were drawn by wire rope throughout on a horizontal line. (11) Suspension lines are used in conjunction with the conveying appliances already described. These lines pass through the coal-sheds, and purifying and revivifying houses; and narrow-gauge lines, with a works locomotive, are also provided. The whole conveying plant is worked from a special engine-room, marked N in fig. 2, in which there are three gas-engines of 30, 50,

and 70 horse power, which drive a shaft nearly 400 feet long running in front of the retort-houses. The gas-engines are of the latest Deutz pattern, with electrical ignition. They are arranged for working either with compressed air at 10 atmospheres pressure from a small compressor and receivers in the basement, or, after a certain number of horse-power-hours has been reached, by means of suction producer gas, which has been proved to be the cheaper under these conditions. (12) A compressor to work West's stoking machinery is installed in the same engine-room. This compressor displays some novelties peculiar to the Crefeld plant. Hitherto the English installations of West's drawing and charging machines have had compressors driven either by tandem coupling of the steam cylinders with the air-compressing cylinders, or by electric power where available. At the Crefeld works, however, the compressors are driven by gas-engines.

A friction clutch has been arranged on the main axle of the compressor, in order not to load the engines more than the power or compressed air actually required entails. This clutches the driving disc of the compressor as soon as the maximum or minimum compression is attained, and automatically throws it in or out of action through the overbalancing of a weighted lever. The weight falls as soon as the minimum pressure is reached, and the friction clutch gears in with the driving disc of the compressor; or, on the other hand, the weight is lifted by the surplus pressure, and the friction clutch comes out of gear with the driving disc. The latter, which is made as far as possible of wood, in order to load the coupling as little as may be, gives a speed of 56 revolutions per minute to the compressor. This corresponds with the compressed air consumed by one set of drawing and charging machines, and necessitates an expenditure of 23-horse power. The driving of the compressor is accomplished by a belt from the principal shaft, on which there are loose pulleys, and Dohmen-Leblanc clutches, so that the compressor can be worked from either of the three gas-engines. Thus the cleaning or stoppage of any one of these engines never causes an interruption of the working of the drawing and charging machines.

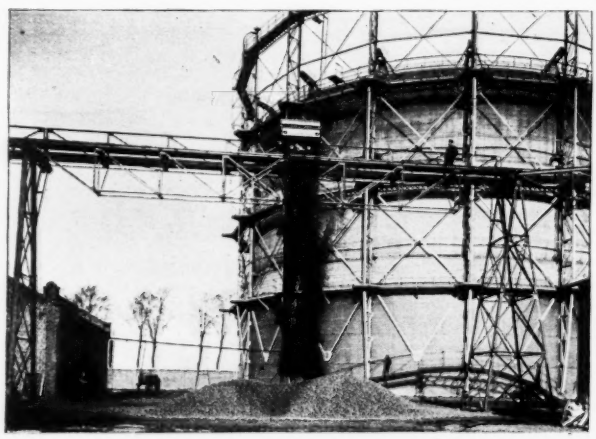


FIG. 8.—THE COKE WAGGONS AT THE TIME OF THEIR DISCHARGE OVER THE COKE HEAP.

The whole installation, including the supply of the drawing and charging machines and compressor, &c., has cost about £21,000. As the number of workmen has dropped from an average of 150, when manual stoking was practised, to not more than 65 a day, or by about 85 hands, at least £4000 a year will be saved in wages; so that the installation returns more than 19 per cent. to cover depreciation and interest charges.

With regard to the drawing and charging machines, it is to be specially observed that they work the length of the retort-house, and that the time required for charging and drawing a retort amounts to a minute. This time covers the filling of the producer, filling the coal receptacle on the charging machine, and lubricating and setting the rake of the drawing machine at the height of the retort to be drawn. Thus with six-hour charges and nine settings, the drawing and charging operation is finished each time in 27 minutes, and the men then have an interval of rest of 93 minutes. This interval will be reduced to 24 minutes per 24 hours when, in consequence of the maximum annual production being attained, the requisite reserve of settings, making 32 in all, are brought into action, or 96 retorts charged and drawn each draw.

The drawing and charging machines are worked by means of high-pressure hose, which rolls on guide-rollers, and is automatically wound and unwound from these for the whole length of nearly 400 feet of the retort-house, so that the coupling and uncoupling necessitated with hydraulic drawing and charging machines is entirely avoided. The number of men required to work the machines is four; making, therefore, with eight-hour shifts, 12 per 24 hours, summer and winter. They do not have to control the required power, because, as already explained, this is done automatically. The charging-machine is moved longitudinally by a compressed-air engine, which also effects the raising and lowering of the scoop, which is in two divisions, and, unlike those of the hydraulic machines, extends the entire length of a retort. The charging-machine carries an overhead coal receptacle, whence the whole of the scoop is filled with the charge of 460 to 530 lbs. of coal at one operation by means of a turbine controlled by a hand-wheel. The scoop, which then carries the coal into the retort, and discharges it there, is guided and supported by an extremely solidly built carrying slit. It passes into the retort twice, tipping out its contents once to the right and once to the left. [Herr Salzenberg has since pointed out that the partition which runs down the middle of West's charging-scoop, serves the purpose of depositing the charge against the side walls as well as the bottom of the retort; so that a more uniform and less compressed layer of coal is secured than by manual charging or by projecting machines. The result is that the surface of the retort is better utilized, and more uniform carbonization of the charge, and a higher yield of gas, are secured with West's machines.] These movements are all effected by automatic, simple, and very solid mechanism within the charging slit itself; the power being supplied to the latter by a special cylinder. The drawing-machine is similarly provided with a motor, so that it can be rapidly moved along the retort-house and worked. The drawing-rake is levelled so that it passes into the retort and only begins to grip the charge at the back; thus completely imitating manual drawing. The two levers for manipulating the insertion and withdrawal of the rake are very easily handled, and constitute, as it were, prolongations of the hands of the operator of the machine. With some practice, and with a properly worked-off charge, three or four insertions of the rake into the retort suffice to draw the whole of the coke. The drawing-machine is provided with a small water-tank, for the cooling of the rake and its supports each time it is withdrawn from the retort, and after the completion of each draw.

Herr Salzenberg states that, so far as he can judge at present, the retort-house wages, with the use of the mechanical conveying apparatus, which, in conjunction with the stoking machinery and the overhead coke line constitute, so to speak, a new type of gas plant, will be lower when the plant is in full operation, than the wages given by Herr Drory for settings of inclined retorts with band conveyors for coal and De Brouwer conveyors for the hot coke. [See "JOURNAL," Vol. LXXIX., p. 478.] This is on the basis of the Berlin rate of retort-house wages, and further, the sums to be written off for depreciation in the case of the

Comparative Cost of Wages for Carbonizing 10,000 *Tons of Coal in Given Time* (17½ *days*).

—	With Inclined Retorts with Band Coal Conveyors, and De Brouwer's Hot Coke Conveyors. (Mariendorf Works.*)	With Horizontal Retorts, with West's Stoking Machines, Elevators, Overhead Coal Reservoirs, and De Brouwer's Coke Conveyors. (Crefeld.)
Total weight carbonized per 24 hours†	571 4 tons	571 4 tons.
Make of gas per ton	10,765 cub. ft.	10,765 cub. ft.
Make per 24 hours	6,150,600 ,,	6,150,600 ,,
Settings of nines required	46	77
Retorts	414	693
Sets of West's stoking machines required‡	..	3
	s. d.	s. d.
Wages	2 foremen, at . . 5 10·5 58 stokers. at . . 5 4·6 5 firemen, &c., at . 5 4·6 4 pipe-jumpers, &c., at . 4 2·0 9 engine, elevator and conveyor men, at 4 5·0	6 foremen, at . . 5 10·5 36 machine-hands, at . . 5 4·6 20 firemen, &c., at . 5 4·6 Work done by foregoing. 6 attendants, at 4 5·0 2 attendants, at 5 10·5
Totals	78 men	70 men
Per 24 hours =	£20 7s. 10d.	£18 15s. 0d.
Total for 17½ days =	£356 17s. 0d.	£328 5s. 0d.
Dimensions of retorts	15 ft. 9 in. × 21 in. × 15 in.	9 ft. 10 in. × 23½ in. × 15¾ in.
Volume of a retort	22·1 cubic feet.	16·7 cubic feet.
Coal carbonized—		
Per retort per day	1·3800 tons.	0·8250 ton.
Per cubic foot of retort space	0·0622 ton.	0·0494 ton.
Wages per lineal foot of retort	1s. 1·1d.	11·5d.
Coal carbonized—		
Per man employed per day	7·32 tons.	8·15 tons.
Per square foot of retort-house area per day	32·7 lbs.	21·8 lbs.
Area covered by retort-house	39,100 square feet.	58,870 square feet.
Cost of Installation of 46 Coze settings of nines (inclines) and 77 generator settings of nines (horizontals)	£56,370	£32,100

* See "JOURNAL," Vol. LXXIX., p. 479.
† Six-hour charges; weight of charge, with horizontal retorts, 463 lbs.
‡ One set for 29 settings, or 261 retorts, and two sets for 24 settings, or 216 retorts each.

retort house with drawing and charging machinery are considerably less than for the more costly retort-house and equipment for inclined retorts. The wages given by Herr Drory are 8·56d. per English ton of coal carbonized. At Crefeld, they amount to 7·88d. per ton, or about 7·9 per cent. less, as the comparative statement of results shows.

The foregoing figures show that 11·4 per cent. more coal was carbonized per man employed per day at the Crefeld works than at Mariendorf. The average wages per man employed are slightly higher at Crefeld.

There is further no question that the charging, as effected by West's machines, of uniformly broken coal in a uniform and equally compressed layer, results in a higher yield of gas being secured. The latest figures, showing the results of the working of the machines at Crefeld to the end of June, demonstrate that the average make of gas per ton of coal carbonized during that month was 11,357 cubic feet, compared with 10,837 cubic feet for the corresponding month last year, when manual stoking was general. This is an improvement of 12·15 per cent. in the make of gas per ton of coal carbonized. The output per retort per diem averaged 9620 cubic feet, or 16·36 per cent. more than in June, 1902.

These facts show that West's machines have afforded not only a great saving in wages, but a largely increased make of gas. Moreover, they have freed the Crefeld works from the trammels which the workmen's Union had formerly imposed; and the Corporation are therefore once again masters in their own works.

After the reading of Herr Salzenberg's paper at the Crefeld meeting, Mr. West, who was present, was called upon to offer a few remarks; and, with Herr Salzenberg acting as interpreter, he made a speech of which we give a summary below.

Herr Salzenberg, in the course of his tour of inspection, visited several English gas-works where West's charging and drawing machinery is in use, and he was convinced, by the testimony of the engineers in charge, that there was no foundation for the statement that the inclined retort system gave better results than horizontals with stoking machinery, provided this machinery was on West's system. It was demonstrated to him—and it has since been substantiated in actual working at Crefeld—that West's machines could do more work on the same settings than could be done by manual stoking. The charge of 507 lbs. of coal put into the retorts at Crefeld when on six-hour work could be increased to as much as 533 lbs. if thought advisable. The trials extended to the whole of the retorts on the works; and none had been in operation for less than 600 days. Doubtless better results would have been obtained with a proportion of new retorts. A very steady level gauge was maintained throughout in the retort-house. The speaker (Mr. West) was not aware that better results had been obtained by any system of working in Germany; and he said he would like to know of any if they existed. The comparison between inclined and horizontal retorts should be between up-to-date installations, and not, as was frequently the case, between inclined retorts with modern improvements and antiquated settings of horizontals. There were works in England and elsewhere where West's machinery had been applied with the very best results to modern settings, equipped with hot-coke conveyors, &c., and other works where it had been adapted to old settings. With the latter, the results, though good, were not nearly equal to what they would have been with up-to-date retort-benches.

For a true comparison of the working of inclined and horizontal retorts, new installations with all the modern improvements of each system must be considered, and compared on the following bases: (1) The capital expenditure on the complete retort-house, (2) the cost of retort-house labour, (3) the quantity of gas made per ton of coal carbonized, and the weight of the charges, (4) the illuminating power of the gas made, and (5) the wear and tear of each system. If this were done, he (Mr. West) knew what would be the conclusion. He was not prejudiced in the matter, as his firm erected plant for either system.

As the result of a visit of some American gas engineers to England last year, six of West's stoking-machines, of the same type as those at Crefeld, had been ordered for the Milwaukee Gas-Works, and some had also been ordered for other towns. Arrangements had now been made for the manufacture of West's machinery in America. Mr. Doherty, the President of the Ohio Gaslight Association, had stated at the recent meeting of that Association, as reported in the "JOURNAL" for the 5th of May last (p. 290), that the tendency in America seemed to be towards horizontal retorts, especially in benches of eights, and machine charging and drawing, rather than in the direction of inclined retorts.

Southern District Association of Gas Engineers and Managers.—On account of the absence of the President of the Association (Mr. Joseph Tysoe, M.Inst.C.E.) from England, under circumstances with which our readers are acquainted, it was found impossible to hold the excursion meeting in June as usual. As he has only just returned, we learn from Mr. J. W. Helps, the Honorary Secretary, that the Committee are of opinion that it would be better to postpone the holding of the meeting until the 17th of September next, when the President hopes to welcome the members at the East Greenwich Gas-Works. Full particulars of the fixture will be given in due course.

PERSONAL.

The minutes of the Water-Works Committee which were adopted at the meeting of the Bath Town Council last Tuesday included a recommendation that the resignation of the Engineer, Mr. CHARLES GILBY, be accepted, and that, in recognition of his long and faithful services to the city, he be granted half-a-year's salary.

We learn that Mr. J. CARTER MOON, Assistant Engineer and Manager to the Ilford Gas Company, has been appointed by the Gas Committee of the Corporation of Nottingham to the post of Superintendent of their Eastcroft works. Mr. Moon is the son of the late Mr. W. J. Moon, for many years Manager and Secretary to the Scarborough Gas Company.

Mr. H. ROWLEY WIMHURST, Manager and Secretary of the Irthlingborough Gas Company, Limited, has been appointed Gas Engineer and Manager to the Spalding District Council, in succession to Mr. J. G. Hawkins. The successful candidate is the son of Mr. H. Wimhurst, of Sleaford. We are pleased to learn that he obtained the position at Spalding by the unanimous vote of the entire Council.

Notwithstanding the severance of the connection of Mr. W. G. BLAGDEN with the Gaslight and Coke Company, as already announced, it will be noticed, from the report of the proceedings at the meeting of the Sulphate of Ammonia Committee which appears elsewhere, that he has complied with a desire expressed by his colleagues, and consented to fill the position of Chairman of the Committee for another year. We learn that the above-named Company have kindly allowed the business of the Committee to be transacted as before at their Salesman's offices, 4, Fenchurch Avenue, E.C.

OBITUARY.

Further particulars in regard to Mr. EUGENE VANDERPOOL, of Newark (N.J.), whose death on the 12th inst. was recorded in the "JOURNAL" last week, have recently reached us, whereby we are able to supplement the account of his life-work then given. Deceased was a native of New Jersey; his father being the late Beach Vanderpool, who was at one time Mayor of the city. He was a graduate of Princeton in 1864, and also of the Troy Polytechnic School. He early became identified with gas interests in Newark, and, as already mentioned, was President of the Gas Company there. This position he relinquished on the amalgamation of the Company with some others in 1895. Though he had practically retired from professional work, he took an active interest in gas engineering till the last. He was one of the Vice-Presidents of the International Gas Congress in Paris in 1900, and at the time of his death was President of the Society of Gas Lighting. Reference was made last week to the late Mr. Vanderpool's connection with philanthropic institutions. In addition to being President of the Howard Savings Bank, he was a Director of the Mutual Benefit Life Insurance Company of Newark, the National Newark Bank, and other large financial concerns. Mr. Vanderpool recently declined a position on the Bench in the New Jersey Court of Errors and Appeals. He is survived by two married daughters and two brothers, his wife having been dead several years.

We regret to record that Mr. J. THOMSON, the Engineer and Manager of the Inverness Corporation gas undertaking, died suddenly at his residence in Inverness on the morning of Saturday, the 18th inst., in his 66th year. His wife died with almost equal suddenness a few weeks ago. He enjoyed good health, and he was of robust appearance; consequently his sudden removal by failure of the heart was quite unexpected. In his early years, Mr. Thomson was in the service of the Edinburgh Gaslight Company, where he received a training in engineering. About 27 years ago, he was appointed to the position in Inverness which he held till his death. As may be supposed, during the time he was in Inverness he carried through extensive alterations and additions to the gas-works; showing considerable aptitude in the adaptation of what was old to modern purposes. His heart was in his work; and, being a capable manager, the undertaking flourished under his guidance. Living at the distance he did from centres of activity in his profession, he did not allow himself to get out of touch with his brethren, but was one of the most constant in attendance at all their technical gatherings. Though he did not make himself prominent at these, his cheerful presence and sunny countenance endeared him to all. Nothing gave him greater pleasure than to entertain his friends and professional brethren at his cosy suburban residence. In the town of his adoption, he was held in the highest esteem. Three sons and three daughters survive him. One son was his Assistant, and another is Gas Manager at Kendal. Another son was Mr. R. B. H. Thomson, who was appointed Manager of the Broughty Ferry Corporation Gas-Works rather more than ten years ago. He unfortunately met with fatal injuries shortly after taking up his appointment. Much sympathy is felt for the survivors in the breaking up of a household which was one of the happiest in Scotland. The interment took place on Tuesday, in the picturesquely situated cemetery close to Inverness.

COMMUNICATED ARTICLES.

A VISIT TO THE MONAZITE SAND DEPOSITS OF BRAZIL.

By Joseph Tysoe, M.Inst.C.E.

If to be filled with one's subject gives the assurance of successful writing about it, this account of my visit to the monazite deposits in Brazil should leave nothing to be desired. For over three months, my waking and sleeping thoughts have been of monazite; for a considerable portion of that period, all my pockets have contained it; it has been impartially distributed about my baggage; and the floors of the various bedrooms occupied by me in my travels have glistened with it.

On arrival in Rio de Janeiro at the end of April, but little time was allowed me for a contemplation of the glorious scenery to be found there, as prompt action was necessary, in order to attain the purpose for which I had undertaken the journey. The evening of my advent therefore found me engaged in the midst of the subject with a high official. For over a month I was occupied in negotiations principally with the Brazilian Minister of Finance, and in picking up information generally which kept me in Rio. On the 29th of May, I left the city on board a Brazilian coasting steamer for Victoria, the capital of the State of Espirito Santo, in which State are situated the deposits which were the subject of the negotiations. It would, I think, be impossible to imagine a more picturesquely situated hotel than the "Grand International," at Santa Thereza, from which I started on my trip. Situated half-way up the Corcovado mountain—about 40 minutes by electric tram from Rio de Janeiro—the view from there is one to which I should utterly fail to do justice were I to attempt to picture it: The Corcovado peak towering above the hotel; the famous sugar-loaf mountain to the right; in front, Nictheroy with a background of mountains; and between, the bay with its innumerable islands, and the city of Rio de Janeiro with its white, blue, green, yellow, and red houses, with the universal red-tiled roofs; not forgetting the gas-works and its holders, which stand out prominently in the middle distance—together make up a picture which must be seen to be appreciated. It was a beautifully clear morning when I started, and Nature was at her best; and I was irresistibly reminded of the lines of the old missionary hymn: "Where every prospect pleases, and only man [and the climate] is vile."

The accommodation on Brazilian steamers is not high class, judged from an English standpoint; but, fortunately, the journey was one of 26 hours only. Victoria is a beautiful place, viewed from a distance; but when I went ashore and presented a letter of introduction to one of the half-dozen Englishmen living there, and was asked to make my head-quarters at his house on an island two miles away, I was more than thankful, and a further acquaintance with the town served to deepen that feeling and to again remind me of the missionary hymn.

One of the things I noticed on entering the bay was the ruins of a gas-works—about all that was left being the guide-framing of a holder, various pipes scattered about, and the mouthpiece end of a retort sticking up from the mud of the foreshore. On inquiry, I found that it is twenty years since the town was lighted by gas; the Company (a Brazilian one) being unable to make it pay. At the present day, kerosene is the chief illuminant. Vultures were perched upon the various portions of the ruins; and, while contemplating them, I could not help thinking that if some people had their way vultures in a different form might be hovering over the ruins of some of our gas-works at home. These birds of prey are very numerous in Victoria; and it is unlawful to kill them, as they take the place of sanitary authorities, and remove all offal from the streets. This must be a distinct saving to the ratepayers, and might be worth consideration in some of our highly-rated districts.

The deposits of monazite sand in Espirito Santo exist at about six points along the coast; the nearest bed to Victoria being at Guarapary, about 40 miles distant. All the deposits are found on the shore; and the State has hitherto claimed the ownership, and granted concessions for working. Recently, however, the Federal Government have awakened to the fact that there is money in it, and have stepped in and claimed the property as their own by virtue of an Act of 1831, which states that the whole of the coast-line of Brazil for a depth of 33 metres above high-water mark, belongs to the Union for defensive and other purposes. At the time of my arrival in Brazil, a Commission appointed by the Government was engaged in marking out this area; and so far as they had gone on the date of my visit to the coast, they had reported that no deposits of monazite existed outside the 33 metres limit. The State Government will, no doubt, vigorously oppose this claim; and a condition of affairs may arise which will take some straightening out.

Two days before leaving Rio, I called upon the Finance Minister, to acquaint him with my movements; and he was good enough to wire to Dr. Silveira da Motta, the Chief of the Demarcation Commission, informing him of my intended visit, and requesting him to afford me every facility and assistance in obtaining the information I desired. I had no definite knowledge of the whereabouts of the Doctor, but thought I should get news of him at Guarapary. The question of getting there, however, presented some difficulty, which was solved in an unexpected manner by the presence in Victoria of the Doctor himself, which fact I discovered two days after my arrival, as I was casting about for means of transport. He intended returning to Guarapary the following day in the Custom House steam-launch, which was at his disposal; and I readily accepted the offer of a passage therein. We arranged to start at 3 o'clock the following morning; but the weather was so bad that we waited until daybreak—about 6 o'clock. Before we got clear of the Bay, however, we met with such heavy seas that we were obliged to return, as the boat could not have lived outside. It was noon of the following day before the weather moderated sufficiently for us to make another attempt; and, after a rough passage of five hours, during which I experienced no little anxiety, we reached our destination.

Guarapary is largely composed of mud-hovels, and the accommodation to be obtained there is of the most primitive description. The possibilities of the "Hotel" at which I stayed may be gauged by the fact that I ate my dinner that evening by the light of one candle. This harmonized with the dinner, which consisted of one course.

At 5.30 the following morning, as arranged, I was on my way to Dr. Motta's shanty; and shortly after, his assistant and myself, mounted on mules, were *en route* for the deposits. A ride of a mile or so over rough ground brought us to the spot. The sands are contained in two large beds—named respectively the "Canto de Riacho" and the "Restinga"—of a combined length of about 2 kilometres. They are in layers of varying thickness, from 1 to 2 metres below the surface; and, in working, the useless sand has to be taken off as carefully as possible, so as to avoid admixture with the monazite. The usual method of preparation for shipment is washing with fresh water, which gets rid of the salt that otherwise rots the bags in which it is exported, and also removes the light sands, which are useless. The remainder usually contains about 90 per cent. of pure monazite, from which from 3 to 4 per cent. of thorium is obtained. The washing is effected in wooden troughs placed at an angle, with a considerable run of water down them; and the sand is thrown up by shovels to meet the running water until a sufficient degree of concentration is obtained. Subsequently, the sand is dried in kilns, put up into bags of 60 kilos., and is then ready for shipment. The weight of monazite sand compared with water is as 5 to 1.

Tables similar to those employed in gold-mining are sometimes used for separating the heavy from light sands. At the time of my visit to Guarapary, no sand was being excavated. Mr. John Gordon, who had a concession from the State of Espirito Santo, had been stopped by the Federal Government; but his men were then engaged in clearing away 800 tons which had already been procured, and for which a special permit had been obtained. This was being conveyed by sailing boats to Villa Velha, about two miles from Victoria, where it was treated and bagged and shipped to Germany.

The value of the "areias amarellas," or yellow sands as they are called in Brazil, depends entirely upon the amount of monazite they contain. Any deposits yielding less than about 15 per cent. of monazite would be, at the present prices, unprofitable to work. Some of the beds in Espirito Santo yield as low as 2½ per cent.

Having finished my inspection of the deposits, and after a long talk with Dr. Motta—during which I endeavoured to imbibe all the information that my knowledge of the language would permit—I prepared to return to Victoria soon after midday in the steam-launch which was placed at my disposal; but shortly learnt, to my dismay, that one of the boiler-tubes had given way just after our arrival the previous evening, and the boat could not return till next day. I did not anticipate with pleasure another 24 hours in Guarapary, but was deeply thankful that the tube had not failed during the voyage, as nothing could have saved us on that rocky coast. This reflection consoled me somewhat. The following morning, the repairs having been executed, steam was got up; but before the working point was reached, the plugged ends of the tube failed, so I at once decided to return to Victoria by land, and procured a horse and guide for the purpose. We got away about 1 p.m., and at 5.30 arrived at a place where we could get accommodation for the night. At 6.30 next morning we were off again, and arrived in Victoria at 11. The launch turned up seven hours later. This ride is one that I shall not soon forget. The scenery in the open parts among the mountains, and the objects of interest in the forest, were full recompense for the inconveniences I had experienced. We did not take the path by the coast—there being no stopping place for the night; and it would not have been nearly so interesting. I had to wait four days in Victoria before I could get a Rio bound steamer; and I left the place without one pang of regret.

Before I left Rio, a fortnight previously, I had succeeded in stopping the signature of the contract which would have handed over all the monazite deposits in Espirito Santo to a Brazilian Syndicate, and had received the assurance that the concession would be immediately thrown open to public competition. When I returned, I quite expected to find that this had been done, and that I should be free to return to England. But matters did not appear to have advanced at all; and I had almost used up the

stock of patience which is such an indispensable part of an outfit for Brazil. However, by dint of frequent calls upon the Minister of Finance—thereby practically exhausting my remaining stock of patience—I extracted a promise that the advertisement should appear on a certain day. It eventually appeared four days after the time promised; and my mission was then at an end.

The Rio newspapers took considerable interest in the subject of these sands; and the various articles and statements appearing therein were both interesting and amusing to me. I may perhaps be permitted to quote, *in extenso*, a paragraph which appeared in the "Gazeta de Noticias" of the 1st of May, which is a fair indication of the general views of Brazilians on the subject: "Our colleagues of the 'Tribuna' yesterday published complete information upon the important question of monazite sands of the Union. From the notice in the 'Tribuna,' it is acknowledged that the Minister of Finance, naturally seconding the methods of the President of the Republic, is really going to sign a contract perfectly guaranteeing the interests of the Treasury. We also know that for exploring the concession, there is now organized a Brazilian enterprise for the export of monazite, whose capital is all subscribed. Treating of a product which, by the studies already made in Europe, can at any moment be turned into a munition of war, the Government shows, by its foresight, that it is not forgetting to seize the opportunity of confiding the exploration of this national wealth to those now interested in the greatness and the development of our country, eliminating completely the possibility of foreign intervention." Readers of the "JOURNAL" now know that this is not correct, and that "foreigners" will have an equal chance with others of securing the concession if they desire to do so.

THE SETTLE-PADFIELD CARBONIZING PROCESS.

By NORTON H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

The publication of my previous notes on this subject * has resulted in some interesting correspondence, which incidentally refers to some of the difficulties connected with vertical retorts, and goes to explain why they have not been more generally adopted. It is singular that none of the troubles indicated appear to have been experienced with the Settle-Padfield experimental retort, which is still (as will be seen by the following results) doing good service, although it has been in almost daily use for two-and-a-half years. This goes to show that the new method of introducing the coal in small pinches, instead of the scoop load, brings about an entirely new set of carbonizing conditions, to which the experiences of ordinary work do not apply. A number of different coals have been tried; and I may at once dispose of the idea that it is necessary to use any selection in respect to the quality of the coal. The specimens that have been operated upon are simply those that happened to be at the Exeter Gas-Works coal-stores at the time. I may add that since the date of my previous test the retort has been repaired, and apparently entered upon a new lease of life, and that every possible arrangement has been made for securing accurate results, including the collection of the tar and liquor, and that the whole is open to inspection, or the patentees would be pleased to arrange for tests of special kinds of coal or other particular investigations under the supervision, if preferred, of the parties suggesting the same. Meanwhile, the following notes may be interesting.

FLOOR-SPACE.

One critic suggests that, with certain modifications, the process might be worth "the excessive floor-space required." On this point it is rather premature to speak, until the bed of six at present under construction has been worked, because the small experimental retort can scarcely give a fair indication of the production under ordinary working. But a bed of six retorts, 9 feet long, occupies a space very little less than that required for the Settle-Padfield set of six—say, 120 square feet against 156 square feet—and the ordinary setting will require a working space in front of not less than 180 square feet. A very much less working space will suffice for the Settle-Padfield retorts. The productive capacity of the ordinary retorts with regenerators would be 40,000 to 50,000 cubic feet per day; and that of the Settle-Padfield retorts would certainly not be less, and probably more. So it is probable that the floor-space required is less rather than more.

QUALITY OF COKE.

The best results as regards yield of gas and sperm value are obtained by using very small charges—say, 2 lbs. each. But the coke produced under such conditions of working is so light and friable as to be worthless. Any quality between this and a hard coke, suitable in point of physical quality for foundry use, can be made at will; but it is assumed that, under ordinary conditions, a hard saleable coke will be required. To secure this, 6 lb. or 7 lb. charges must be used; and the following tests were conducted under these conditions.

* See "JOURNAL," Vol. LXXXII., p. 881.

SOME FURTHER RESULTS.

With experience in working, there has followed, as might be expected, a considerable improvement in results; and I give below some of the latest obtained:—

Coal Slack.	Durham. Hebburn.	Somerset. Newbury.	Durham. South Pelton.
Make per ton, cubic feet	12,710	12,064	12,719
Average Illuminating power, candles	13·7	14·0	13·7
Coke, pounds	1590	1600	1681
Tar, gallons	5·73	6·06	3·92
Liquor, gallons	10·75	13·37	15·36
Sperm value, lbs. per ton	597	579	598

These results are in each case the average of ten charges of 224 lbs. each.

NO TAR.

In some of the foregoing experiments, it was noticed that tar almost entirely disappeared; and it was decided to return the tar to the retort as fast as formed. This arrangement has been in successful operation for some weeks, and shows a marked advance in results. The following are the figures obtained as the average of ten experiments of 224 lbs. each, on each coal:—

	Durham. Hebburn.	Somerset. Newbury.	Durham. W. Leverson.
Make per ton, cubic feet	13,358	13,265	13,570
Average illuminating power, candles	13·8	13·6	13·5
Coke, pounds	1620	1630	1620
Tar, gallons	—	*nil*	—
Liquor, gallons	11·4	15	9·20
Sperm value, lbs. per ton	631	617	628
Gain by using up the tar:			
Gas per ton, cubic feet	648	1201	—
Sperm value, lbs. per ton	34	38	—
Coke, pounds	30	30	—

COMPARISON WITH ORDINARY WORKING.

The following tests were carried out on the works under ordinary working conditions:—

	West Leverson.	Hebburn.	South Pelton.	Newbury.
Gas per ton, cubic feet	10,156	10,537	9,577	10,135
Candle power	14·54	14·33	14·	14·3
Coke, pounds	1,648	1,570	1,677	1,554
	Average of 54 tons	Average of 46 tons	Average of 27 tons	Average of 73 tons
Sperm value, lbs. per ton	506	517	460	496
	Gain, per ton.			
Gas, cubic feet	3,414	2,821	—	3,130
Sperm value, lbs. per ton	122	112	—	122
Coke	—	50 lbs.	—	76 lbs.
	Gain, per cent.			
Gas	33	27	—	38
Sperm value	24	22	—	24

SOME INTERESTING FINANCIAL RESULTS.

The small coal used for the tests can be obtained at about two-thirds the price of ordinary unscreened gas coal; and in some cases the value of the coke alone is about equal to that of the coal. For example, taking present prices, coal at 10s. 6d. and coke at 16s. 8d. per ton: One ton of coal, costing 10s., will yield 12 or 12½ cwt. of coke available for sale, after providing for fuel under the retorts. The ammoniacal liquor represents a profit on the transaction; so that the cost of the coal becomes a *minus* quantity. Thus:

	s.	d.			s.	d.
Coal	10	6	Coke, say		10	0
			Liquor		2	0
					12	0

Another feature is the result of using up the tar, one consequence of which is a gain of 30 lbs. of coke per ton. The net receipt for the ton would not exceed 2¼d. per gallon—say, 9d. Against this, the 30 lbs. of coke are worth 3d.; leaving 6d. to pay for the 600 to 1000 cubic feet of additional gas.

The Birmingham Magazine of Arts and Industries.—The third annual volume of this magazine has been issued; and if we may judge others by ourselves in reference to it, a very large number of people who are not immediately concerned in the great Midland city will find the contents very engrossing. The Editor (Mr. W. J. Spurrier) is to be congratulated upon the production. He possesses the happy faculty of writing about all kinds of subjects in a chatty vein; and he has a very keen eye for artistic merit. The number and character of the illustrations give proof of this, and further satisfaction on this point is obtained from the style in which the volume is turned out from cover to cover. The contents of the book are too diverse to cause monotony to the reader; and the subjects range from the personal to the educational and industrial. The municipal gas-works and the manufactories associated with our industry in Birmingham have several chapters devoted to them, and to the men who have had a hand in raising them to their present importance. The Editor is not narrow-minded, however; and while he gives so much space to gas matters, he does not neglect electric lighting. But these are only two out of many topics in the new volume, to the interest in which there are no bounds. It is published by the Birmingham Magazine Company, No. 1, Stanley Place, Moseley.

TECHNICAL RECORD.

PROCEEDINGS AT THE GERMAN ASSOCIATION MEETING AT ZURICH.

(*Continued from p.* 173.)

The accounts of the Mariendorf works of the Imperial Continental Gas Association at Berlin, by Messrs. Drory and Körting, and of the Crefeld Gas-Works by Herr E. Salzenberg, formed the subject of a brief but lively discussion on the second day (the 25th of June) of the meeting.

Inclined Retorts v. Stoking Machinery.

At both works, the attempt to do away with manual labour as far as may be has been made in a very thorough manner. At the Mariendorf works, the system of inclined retorts has been adopted; while at Crefeld the object aimed at has been achieved through the instrumentality of West's stoking machinery applied to horizontal retorts. Both modes have succeeded in effecting very great economy in wages and reduction in the number of workmen employed; but the question as to which of the two had actually done best in this direction naturally invited discussion, for which, however, time was very limited at Zurich. Now that the comparative figures for the two works and systems of working are published to-day (*ante*, p. 232) in our columns in a more complete form than that in which they were presented to the meeting at Zurich, the discussion which the exigencies of the full programme there curtailed all too much, may perhaps be resumed in the pages of the "Journal" and its German contemporary. The Crefeld results with horizontal retorts stoked by West's machinery certainly throw down a challenge to the supporters of the system of inclined retorts to show that they can do as well or better under similar conditions, and it is a challenge which cannot be lightly taken up.

We shall, as already stated, shortly return to the Mariendorf works, and give some particulars supplementing the account of them which appeared in the "Journal" last year.

The discussion on the two papers was opened by Herr Terhaerst, of Nuremberg, who referred to the construction of the retort-house at the gas-works in that city. He said that he believed it was superior in respect of ventilation, maintenance, and first cost to the Mariendorf retort-house; but Herr Körting controverted this view in his reply to the comments on the paper which he and Mr. Drory had presented. He also thought the direct comparison of working costs which Herr Salzenberg had made (*ante*, p. 232) could not be fairly taken without an intimate knowledge of the local conditions. Herr Salzenberg, in reply, quoted figures, similar to, but less complete than, those that are now given in the "Journal" (*ante*, p. 232) to show that at the same rates of wages the working was cheaper at Crefeld than at Mariendorf—a result which he attributed to the West's stoking machinery in use at Crefeld.

The Mazza Separator.

Dr. Bunte next drew attention to a pamphlet which had been circulated at the meeting descriptive of the "Mazza Separator." This apparatus, which aims at separating the components of gaseous mixtures, according to their densities, by means of centrifugal action, has been referred to in the "Journal" on several occasions. It is the invention of Signor E. N. Mazza, formerly an officer in the Corps of Italian Military Engineers, and the descriptive pamphlet was from the pen of Captain Vittorio Calzavara, the Editor of our Italian contemporary "Il Gaz." The chief use to which the apparatus has been put is for the treatment of the air supply to boiler-furnaces; and it is claimed that it effects a partial separation of the components of atmospheric air, so that air which is appreciably richer in oxygen can be delivered under the fire-bars. The consumption of boiler-fuel has been reduced by from 16 to 23 per cent. in works where the apparatus has been applied. Various uses are suggested for the apparatus in connection with gas-works—such as the separation of hydrogen and methane from the heavier constituents of coal gas, with a view to their introduction into the retorts during the carbonization of coal, instead of water gas as proposed by Professor Lewes; and the separation of the impurities of coal gas, blast-furnace gas, and other fuel gases. Dr. Bunte said he did not think that the information hitherto published carried conviction as to the practicability of the apparatus, the action of which ran counter to the generally accepted ideas as to the nature of gases.

Sterilization of Drinking Water by Ozone.

The next communication taken was a paper by Dr. G. Erlwein of the firm of Siemens and Halske, of Berlin, on the "Sterilization of Drinking Water by Ozone, and Ozone Water-Works." The author referred first to the different sources of water, and said that for deep-well water, sterilization was scarcely ever required. But surface water, if it was to be used for drinking purposes, ought to be purified, as it generally contained pathogenic organisms. He described the ordinary filtration methods, and went on to say that treatment by ozone had been proved to destroy with certainty the objectionable organisms. Ozone for the purpose was produced by passing atmospheric air into ozonizing apparatus in which it was subjected to the silent electric discharge. This ozonized air was brought into intimate contact with the water to be sterilized, by driving it through a tower in which the water trickled in a finely divided state through a 6-foot to 7-foot layer of coarse sand. A portion of the ozone was thus absorbed by the water, and had the effect of killing the bacteria and improving the water both physically and chemically. Experiments made at the Imperial German Bureau of Hygiene and at Koch's Institute showed very favourable results when waters containing cholera, typhus, and enteric bacteria were subjected to the ozone treatment. It had been found in practice that only 1·3 to 2 grammes of ozone were required to sterilize 1 cubic metre of water, and that 1 cubic metre of ozonized air contained 1·8 grammes of ozone. The cost of the treatment amounted to from 0·4 pf. to 0·9 pf. per cubic metre of water—say 0·2d. to 0·5d. per 1000 gallons. In practice, the process would not supersede sand filtration under ordinary conditions, as had at one time been supposed; but ozone sterilization could be applied advantageously where space was not available for extending the filtering beds, where it was necessary to take steps to improve the taste and smell of the water owing to the presence in it of organic iron or other compounds not precipitable by aeration, and where adequate supervision of the ordinary filtration processes could not be maintained.

By the aid of models and diagrams, the author described the ozonizing plants at Schierstein in Wiesbaden and at Paderborn. It was impossible in practice for unsterilized water to escape from these installations, and adequate means had been provided against the dangers of the high-tension currents used. The Paderborn plant was working with the best results in sterilizing the water of the River Pader, which was not quite free from suspicion. At Wiesbaden, however, conditions had improved so much that it had become unnecessary to treat the water for the removal of bacteria.

Several technical men—including Professor E. J. Constans, of Zurich, and Heer Kremer, of Amsterdam—joined in the discussion on this paper; and, in his reply, Dr. Erlwein supplemented the particulars which he had given by figures, &c., which for convenience have been here included in the foregoing summary of his paper.

High-Pressure Water-Mains.

The next communication was an account by Herr R. Meier, the Manager of L. von Roll's Iron-Works at Solothurn, of "High-Pressure Mains laid with Cast-Iron Socket-Pipes, and the Accessory Apparatus." The author said that flanged joints had been found to be too rigid and too costly, and his Company had accordingly adopted socket-jointed mains for high-pressure water supplies. The iron used was specially suitable, and the sockets were made longer than usual, and tapering, so that the lead packing was not easily forced out by the high pressure of the water. A cast-iron ring attached to the rim of the socket by a number of screw-clamps also served, when the pressure was exceptionally high, to retain the lead ring. A large number of mains had thus been laid during the last 20 years in diameters ranging from 3 in. to 18 in., and for pressures of 24 to 60 atmospheres, and the results had been quite satisfactory. One of the largest installations was in connection with the water supply of St. Gallen. It was a main nearly 14 inches in diameter, having a length of over 32,000 feet. The pressure of the water was nearly 540 lbs. per square inch. Special valves, &c., were employed, and these were in many cases operated by hydraulic power.

The Hygienic Aspects of Gas Lighting.

The lecture which Professor Renk, M.D., of Dresden, was to have delivered, on the "Hygienic Aspects of Gas Lighting," fell through, owing to the Professor's inability to attend the meeting. Dr. Schilling, of Munich, however, offered some observations on the subject in place of Professor Renk. It was contemplated putting up in Munich an installation of incandescent gas lighting, embodying the latest advances, for the purpose of demonstrating that this method of lighting afforded great advantages in every respect, and was capable of competing even with indirect lighting by electric arc lamps. The support of the Munich Hygienic Institute and of the Eye Hospital had been secured for the pursuit of these investigations, which would be made for the Association of Gas and Water Engineers. The researches were to cover ordinary incandescent lights, high-pressure gas-lights, and electric arc lamps—for purely indirect as well as for diffused lighting. A lecture-room at the University and an experimental room at the Munich Technical College had been put at disposal for these researches, which were to include the measurement of surface illumination, the determination of the proportion of carbonic acid, moisture, sulphuric acid, and nitric acid in the air, and the temperature, the influence of existing ventilating means on the state of the air, the sharpness of delineation, the determination of differences of colour, the steadiness of the flame, and finally the cost. The scheme of Dr. Schilling here outlined was brought up in connection with the report of the Association Committee on Heating; and the grant of £100 required for carrying out the proposed investigations was made at the meeting.

Reports of Technical Committees.

The reports of the various Committees appointed by the Association at its last or earlier meetings were next received and dealt with, as indicated in the following summaries of their contents and recommendations.

The report of the Committee on "Photometry" was presented by Herr Thomas, of Zittau. It stated that the Committee sat twice, and had considered the question of apparatus for burning off mantles; but their investigations thereon had not yet been completed. It was proposed to continue them, and to study the resistance of mantles to shocks. Another matter to be further investigated was the increase in brightness which many mantles displayed after being in use for several hours. It would have to be considered whether, in consequence of this phenomenon, the durability tests of mantles on the photometer would not have to be conducted in future under different conditions. The regulation of the air supply to Welsbach burners, and its effect on their lighting duty, had also to be dealt with. The photometric equipments of the gas-works laboratory at the Town Exhibition in Dresden had been settled after exhaustive deliberation. The different points in the programme of the International Committee on Photometry—which had met at Zurich a few days before the general meeting of the Association—had also been exhaustively discussed in advance; and as it was anticipated that the deliberations of the Committee would raise further questions for investigation, the Association Committee proposed that a grant of 600 marks (about £30) should be made for the ensuing year. The meeting made the grant asked for.

The report of the Committee on "Standards of Gasholder Construction," was presented by Herr Helck, of Carlsruhe, in the unavoidable absence of the Chairman, Herr M. Niemann, of Dessau. The skeleton agreement and specification which had been earlier prepared [see "Journal," Vol. LXXIX., p. 634] was further discussed, and some changes were made in it as the upshot of a conference between the Committee and a representative deputation of gasholder makers. The Committee recommended that: (1) The Association approve the skeleton specification; (2) General recognition of it by kindred bodies be sought; and (3) The Committee remain in office to collect data and carry out the necessary supplementary work. These recommendations were adopted at the meeting.

The report of the Committee on "Heating" had been on this occasion combined with that of the Committee on "Gas-Meters," because the two Committees had worked together to oppose the restrictions which certain Trades Unions had sought to impose on fitting being carried out by gas and water works. As the result of deliberations, a manifesto, drafted in the first instance by Herr Schäfer, of Dessau, was adopted and published by the Committees. Its purpose was to demonstrate in clear fashion to the public and to those directly interested, that the monopoly of fitting work which the Unions sought to secure for their members should not be permitted.* Herr Körting, of Hanover, as Chairman of the Committee on "Heating," said their special work had not progressed owing to the disability of Professor Junkers; and he therefore proposed that the Committee should remain in office, and be allowed a grant of 2000 marks (about £100) for the ensuing year. The proposal was agreed to.

Herr Söhren, of Bonn, on behalf of the Committee on "Gas-Meters," proposed that it should continue in office another year, and be granted 600 marks (say, £30). The grant was made.

Herr Lindley reported on the work of the Committee appointed to establish "Protective Regulations in Regard to Electrolytic Action on Mains." The Committee had failed to arrive at an understanding with the electricians, but anticipated a change in their attitude because electric cables were now being affected by earth currents. The investigations had not yet been concluded, and it might be necessary to engage an electrician to study the question and make researches. A grant of 700 marks (say, £35) for carrying on the work of the Committee was asked for, on the understanding that the expenditure might exceed this sum if the special study referred to were undertaken. The meeting agreed to this request.

Dr. Bunte reported on the work of the "Instructional Committee." The gas-fitting schools at Dessau and Bremen, and the course of instruction on gas at Carlsruhe had been continued as before. A communication from the Minister of Commerce, with reference to the establishment of a course of instruction for fitters at the Royal Engineering College at Cologne, was read and referred to the Committee.

The report of the Committee on the "Working of Water-Works" was presented by Herr Wellmann, of Charlottenburg. It stated that the Committee had studied the statutory regulations issued in the different districts of Germany, and had found that they did not meet practical requirements. They had, therefore, framed a set, which was to be laid before the Prussian Minister of Arts, with a request that he would let the Royal Experimental and Testing Works for Water Supply and Drainage co-operate in the matter with the Committee. The report was adopted.

The report of the Committee for "Water Statistics" was presented by Herr Joly, of Cologne. It set forth that statistics had been collected for the year 1901-02 from a large number of German and Austrian Water-Works, and that these were being tabulated and plotted on a diagram in a somewhat different form from that hitherto adopted. For printing the tables, &c., a grant of 4000 marks (say, £200) for the ensuing year was asked for, and was made by the meeting.

All the Committees mentioned in the foregoing reports of their proceedings were re-appointed for the ensuing year, with slight changes in their constitution in one or two instances only. One feature in connection with these appointments which will strike English gas engineers as noteworthy is the substantial grants made through these Committees for the furthering of specific objects bearing on the progress of the gas and water industries. In all, a sum of nearly £580 was placed at the disposal of these Committees for carrying on their work during the year 1903-04.

* The concluding arguments of this manifesto are reproduced on p. 238.

Dr. Steger on Water Gas.

The next proceeding was the reading by Dr. A. Steger, of Amsterdam, of his valuable paper on "Water Gas," of which we gave a tolerably full abstract translation last week (*ante*, p. 173). The discussion on it was limited to a few minutes, owing to the mass of technical matter on the programme which remained to be dealt with. Herr Dicke, of the Dellwik-Fleischer Water-Gas Syndicate, of Frankfort-on-the-Maine, Herr Croissant, the Manager of the Ludwigshafen Gas-Works (where the Lewes self-carburetting process is in operation), and Dr. Strache, of Vienna, said only a few words, in reply to which Dr. Steger offered to place the Kramers-Aarts experimental plant at Dongen (in Holland) at their disposal at any time for further investigation of the process which he had described in his paper.

A Swiss High-Pressure Gas Supply.

The gas-works of St. Margrethen, and the gas supply of the surrounding communities by means of high-pressure mains, were described by Herr A. Rothenbach, of Berne. An account of this interesting installation has already been given in the "Journal" [see Vol. LXXXI., p. 769]; and it will therefore suffice to say now that the author recommended the supply of gas from a central works at St. Margrethen in the Rhine Valley, near the lake of Constance, to a number of small places in the vicinity, instead of erecting small gas-works at each of them. The scheme was successful, as will have appeared from the article referred to. In the discussion on the paper, Herr Hase, of Lubeck, mentioned that Travemünde was supplied with gas from Lubeck by means of a main 19½ kilometres (say 12 miles) in length. The gas was made at Lubeck, at a quarter of the cost at which it could be produced at Travemünde; and the cost of distributing it to the latter place was very small—especially as a number of small intermediate places were supplied *en route*. Herr Eisele reported that a similar scheme had lately been adopted near Heidelberg.

Prepayment Meters.

Dr. H. Aron, the distinguished Berlin Professor, next read his paper on "Prepayment Gas Apparatus," of which an abstract is given to-day on p. 239.

After Herr Miescher, the Manager of the Bâle Gas-Works, had offered to show to any members who might be returning home by way of Bâle, the De Brouwer retort-charging machine at his works, there remained only the private business of the Association to be transacted.

Annual Report.

The first item in the private business was the presentation of the annual report of the Council, which was adopted. It opened with a fitting reference to the loss the Association had sustained by the death, on Sept. 23, 1902, of the oldest honorary member, Dr. W. Oechelhaeuser. A new set of rules had been framed, and was laid before the meeting, embodying such changes in the constitution of the Association as were required to give it the rights of a person in the German Law Courts. The prize competition for Artistic Gas-Fittings, promoted by the Association [see "Journal," Vol. LXXXI., p. 345], had resulted in 126 designs being submitted by 101 competitors, of whom five were awarded prizes. It will be remembered that the competition was limited to German firms. The Association had also endeavoured to further technical as well as artistic merit in domestic gas-fittings by means of a pamphlet on the subject. The recent manifesto with reference to the pretensions of the Gas and Water Fitters' Unions, alluded to in connection with the reports of the Committees of the Association [*vide supra et infra*] comes in for notice. The Town Exhibition at Dresden, which has has a special section for gas and water works, has had the assistance of the Association in forming an exhibit of the latest scientific apparatus and methods for the examination of the raw materials and intermediate and final products of gas manufacture, and for the chemical and bacteriological investigation of water. The exhibit comprises a fully equipped photometer-room, and gas and water works laboratory. There is also an exhibit of gas apparatus, &c., of historical interest. It is proposed to arrange for members of the Association to visit this exhibition together later in the year. Reference is made to the meeting of the International Committee on Photometry, and to the work of the various Committees of the Association. The membership has increased from 877 at the close of the preceding year to 910, of which total 1 is an honorary member, and

157 are Associates. The remainder are ordinary members. There are eight affiliated Associations. There were 49 contributors to the fund raised by the Association for promoting its scientific work; and a sum of over £600 was thus collected. Among the gas-works which contribute to this fund are five of the stations of the Imperial Continental Gas Association.

The accounts of the Association, and estimates of receipts and expenditure for the ensuing year, were next considered and passed; and new members of the Council were elected. Herr Körting, of Hanover, was elected President for the ensuing twelve months; and Hanover was chosen as the place for next year's meeting—the Mayor of that city having telegraphed to express his hope of welcoming the Association there on behalf of the Municipality. The preceedings concluded with a hearty vote of thanks to Herr Beer for his conduct in the Presidential Chair during the past three years.

Manifesto of the Association on the Attempted Restraining of Gas and Water Undertakings from Carrying Out Fitting Work for Consumers.

This manifesto, which has already been referred to, is a long document setting forth in detail the objections raised by various German Unions of plumbers and fitters to gas and water works undertaking fitting work, the preventive measures threatened by them, and the grounds on which the Association consider the movement prejudicial to the gas and water industries. We are only able to reproduce the concluding recommendations of the Association. The Heating and Meter Committees of the Association assembled for mutual deliberation on June 24, 1902, and drew up a manifesto on the fitting work operations of gas and water undertakings, which was discussed and approved by both these Committees on Jan. 31 last. After consideration of the matter on the basis of the statements set forth in full in the manifesto, the Association declares that the ordinance emanating from several associations of fitters, smiths, and plumbers, in which an attempt is made to prohibit fitting work being undertaken by gas and water authorities, is opposed to the interests of those works and their customers. It recommends the rejection of all the petitions and proposals which aim at this: (1) Because the arguments adduced therein are not valid. (2) Because the business of fitting is for gas and water works, and especially for the former, for technical as well as financial and economical reasons, not only advantageous, but quite indispensable. (3) Because by the promulgation of the prohibition, the continued introduction of service-pipes and apparatus on the hire system, and the installation of prepayment meters, as well as other necessary measures for the development of the undertakings, would be suppressed. (4) Because the further objects of the opposing associations, as made known by proposals, resolutions, &c., would undoubtedly be prejudicial to the interests of the consumers, and therefore also to the gas and water works. (5) Because by the issue of this prohibition a precedent would be created, giving rise later to further troublesome and injurious limitations in industrial works in towns.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Chester Gas-Works.

The members of the above-named Association had a very pleasant outing on Saturday at Chester, where, by permission of the Engineer and Manager, Mr. J. C. Belton, they were afforded an opportunity for a thorough inspection of the gas-works, which, as readers may remember, have during the last three years undergone considerable extension and reorganization on modern lines.* The party, which numbered about 25, were received at the works by Mr. Belton and by Mr. F. A. Pye, the General Manager.

Mr. Belton said they were exceedingly pleased to afford the members of the Association every facility for a full inspection of anything that might be of interest to them in the works, of which he gave a brief preliminary description before the party proceeded through the departments.

Mr. Pye said he had come down to express the pleasure which the Directors of the Company had in opening the works to the members. Chester was an antiquated city, and perhaps on this account they must not look for the most up-to-date works; but since Mr. Belton had become the Engineer and Manager, they had, under his direction, been brought up to modern practice, and the production had been largely increased. Mr. Belton came when the demand was up to the full capacity of the works, and there was urgent necessity for meeting increasing requirements. The task before him was not an easy one; and it would no doubt interest the members to see how he had successfully overcome his many difficulties. He had said that Chester was an antiquated city; and there was one antiquated point about their works which he might mention, and which was probably due to the personal influence of Mr. Belton. The men worked in hearty association with the officials, and there was no Trade Union dictation among them.

Mr. Belton then conducted the party through the works, where arrangements had been made for giving practical demonstration of the new processes and improvements introduced. The retort-house, as altered in connection with the reorganization of the works, consists of 14 through arches, each containing two beds of eight retorts; making a total of 224 mouthpieces. The fuel is supplied by one furnace to each through arch on the coal-store side. The hydraulic mains are supported on transverse girders. The outlets to the hydraulics go into 12-inch receiving mains, which are connected at both ends of the bench to two rectangular condensing mains. From these the gas passes to the condensers outside the house. The remainder of the plant consists of duplicate exhausters, a 60,000 reciprocating and an 80,000 four-blade rotary, and a 60 ft. by 12 ft. tower scrubber, with Livesey washer underneath, supplemented by a Clapham washer. There are six purifiers, each 24 ft. by 22 ft., four oxide and two lime. The station meter and governor are of the Gas Meter Company's manufacture. There are two holders with ordinary framing, and one on the Gadd and Mason principle; the total storage being 1,150,000 cubic feet. The works were built for a production of a million cubic feet per day; but with the retorts as altered the capacity has been increased to 1¾ millions; and it is contemplated to further raise the production as circumstances may render this necessary. One of Marsh's patent rotary meters is used to record the quantity of air passed into the purifiers for the revivification of the oxide *in situ*. The carbonizing plant consists of duplicate coal breakers, elevators, conveyors, and storage hoppers, worked by two gas-engines, and two sets of West's manual charging and drawing machinery. The removal of the coke is effected by means of waggons running upon rails in the retort-house, and brought over turntables to the coke-yard, where a locomotive crane on an elevated gantry lifts and discharges the coke into stacks, where it is stored for loading in carts for sale.

On the conclusion of the inspection, Mr. Belton gave some details with regard to the results obtained since the reorganization of the works. The adoption of regenerator settings had, he said, resulted in great economy of fuel, and in the largely reduced cost of carbonization. The coke sold during the past half year had been 10·87 cwt. per ton of coal, compared with 7·63 cwt. under the old system. The coke used as fuel under the retorts had been 9·52 cwt., against 27 cwt. previously.

Returning to the offices, the members were entertained to tea by Mr. and Mrs. Belton.

The President (Mr. S. E. Halliwell, of Littleborough), after expressing his personal appreciation of the hearty hospitality with which the members had been received, together with the exceptional interest of their visit, said he was sure they would be anxious to convey, in the customary manner, their thanks to Mr. and Mrs. Belton for their great courtesy and kindness, and also to Mr. Pye and the Directors of the Company for the permission they had given to inspect so unreservedly all the departments of their works.

Mr. R. H. Ginman (Tyldesley) seconded the proposition; and the vote was enthusiastically accorded.

Mr. Belton, in responding, said he thanked the members most sincerely for the very kind and hearty manner in which they had expressed their appreciation of anything he had been able to do for the Association. He would be very pleased to convey their vote of thanks to Mr. Pye and the Directors, while he also wished to gratefully return acknowledgments on behalf of Mrs. Belton and himself.

Before the proceedings terminated,

The President said there was a matter of special interest to the members which, with the permission of Mr. Belton, he desired to bring forward. They were probably all aware that Mr. E. J. Wellens, who had received the appointment of Manager at the Hebden Bridge Gas-Works, had, in consequence, been compelled to resign his position as Secretary to the Association, with which he had been associated from the first; and they felt that some recognition was due to him for the great assistance he had rendered. On behalf of the members, he had great pleasure in presenting to Mr. Wellens, as some token of their appreciation of his services, a gold watch, which, with his monogram, bore the inscription: "Presented to Mr. E. J. Wellens by the Manchester and District Junior Gas Association, on his retirement as Secretary, June, 1903." In addition, he also had pleasure in presenting Mr. Wellens with an umbrella and walking-stick, each with a silver band and his monogram; and he asked Mr. Wellens to accept these as some evidence of the high appreciation in which he was held by the Association.

Mr. Wellens said this presentation had come upon him as a complete surprise, and he scarcely knew how to adequately thank the members. He could only say that he deeply appreciated what they had done. As to any services he had rendered, it had always been a pleasure to him to do anything that could promote the progress and well-being of the Association; and in this he had received so much assistance from the Council that his work had been rendered easy. It was a great gratification to know that the Association were on the right course, and that from a small society of six at the commencement, they had grown to a membership of over sixty—a fact speaking for itself, and evidence that the organization was being conducted on right lines.

* The improvements were described in a paper read by Mr. Belton at the meeting of the Midland Association of Gas Managers on Oct. 11 last year. (See "Journal," Vol. LXXX., p. 1011.)

PREPAYMENT GAS APPARATUS.

By Dr. H. Aron, Professor and State Councillor, of Berlin.

[Abstract Translation of a Paper read, on June 26, before the German Association of Gas and Water Engineers at Zurich.]

The subject of prepayment gas-meters has been several times brought before the German Association; and it is only necessary to carry the information already given up to date. On the whole, Germany has taken up prepayment meters very slowly. In 1900, about 25 German gas-works had adopted them; but there has been a considerable advance since then. For instance (to quote individual cases), Berlin in 1900 had only 143 out on trial; while this year about 10,000 are in use there. At Carlsruhe, the numbers have advanced from 602 to 1332 in the same period. The number of gas-works which supply these meters appears also to have doubled since 1900; and it would seem that this is the eve of a great development in this direction.

Looking at the extension of the prepayment system in other countries, it is noticeable that of the 4,430,739 consumers in 1902 in Great Britain, 1,126,572, or over 25 per cent., were supplied through prepayment meters. In 1901, the corresponding percentage of the total consumers was only 18·2. Turning to individual undertakings, the South Metropolitan Gas Company began to instal prepayment meters 15 years ago; and in 1902, 139,113 out of 249,374 consumers of all classes were supplied through them. That is to say, over 50 per cent. of the customers of this Company are on the prepayment system. Further, there are 79 other English gas undertakings in which the prepayment consumers outnumber the others. Copenhagen, in 1902, had 14,000 prepayment meters, which, however, were only for supplies for cooking purposes. At Amsterdam, there has been an enormous development in the use of prepayment meters since 1899, when there were only 1869 fitted. In 1902, the number had risen to 15,630.

These figures indicate how powerful a factor the prepayment meter has now become in gas supply. This is attributable to its many advantages; and, notably, to the incentive it affords to economy in the use of gas. Consumption is by it brought under ready control, whereas few of the larger consumers trouble to read their meters in order to exercise supervision on the consumption in their households. Especially in cooking, does the prepayment meter make for the economical use of gas. The spread of the prepayment meter does not appear to be due, as has sometimes been supposed, to the fact that service-pipe, boiling-ring, and burner are supplied with it, because the German Continental Gas Company had for many years previously let such apparatus on hire without experiencing the great extension of business which followed the introduction of the prepayment meter. It is essential to success that the apparatus should be as perfect as possible.

The manufacture of prepayment apparatus has naturally developed in England; and the apparatus which has so far been made in Germany follows the English patterns. The author has endeavoured to devise a new type of apparatus which he thinks embodies several improvements. For instance, he has made the coin-feeding passage wide enough to prevent a bent coin sticking in it, while an anchor prevents a second coin jamming with the first should two be put in one directly after the other. Further, the clockwork usually requires too great force to operate it; so that any failure is not so readily detected as if it were operated with ease. To overcome this defect, the author adopts a gearing in which one canting-wheel turns the axis of the planet wheel with the help of the coin so as to allow the free passage of the gas; while the other canting-wheel is driven by the gas-meter, and moves the planet in the opposite direction to shut off the gas. Similar gearing has been used for 18 years on large numbers of the author's electricity meters. Its production, therefore, on a large scale, with adequate precision, presents no obstacle to its employment.

With regard to the mechanism for shutting off the gas, two different types of construction are possible, of which one only has hitherto been used in Germany. This is the direct shutting off of the gas by a valve. The alternative is to stop the working of the meter. In practice, the valve does not remain for long quite tight, and some leakage of gas takes place. It, however, is so slight that *per se* it would not be of great moment. But the pressure of the escaping gas on the extended surfaces in front of the valve becomes considerable after a little while, and the mechanism is gradually forced on thereby, and suffers injury through bending of teeth, locking of wheels, &c., or at least is caused to register incorrectly when again put in action by a coin. The type in which the passage of the gas is cut off indirectly by the stoppage of the gearing presents the disadvantage of a sudden stoppage of the gas supply, without preliminary warning thereof being given to the consumer. The author has endeavoured to combine the advantages of these two methods, and to avoid their disadvantages. When the apparatus is put in action, both a valve is fully opened and an arrangement for stopping the gearing is set free. When the consumption is about to bring the supply to a close, the gradual closing of the valve gives warning of the impending occurrence; and the gearing is afterwards stopped and completes the shutting off of the gas. This combination of the two modes requires certain constructional conditions to be fulfilled, and this has been successfully done.

The question of the rate of charge with prepayment apparatus is a most important one. All restrictions such as the limitation of the use of the supply to cooking purposes, the imposition of a minimum charge per quarter, &c., appear to be harmful. They are in vogue chiefly on the Continent, and do not prevail in England, where most experience with prepayment meters has been gained. The simplest rate of charge is the best. Even in places where ordinarily different prices prevail for gas supplied for lighting and for gas for cooking, &c., it is best to take the mean of these two prices for the prepayment supplies, and add to it merely the necessary charge for interest and depreciation on the meter, fittings, &c. What this additional charge should be must depend on local circumstances, and in particular on the average annual consumption per prepayment meter, which varies within wide limits. Taking an average consumption of about 14,000 cubic feet per annum, an addition of about 10d. to the ordinary price per 1000 cubic feet appears to be justifiable in the case of gas supplied through prepayment meters. The addition in any case should not exceed what is necessary just to cover interest and depreciation charges.

The introduction of prepayment meters into the smaller houses undoubtedly conduces to a higher degree of civilization in the community at large.

[One of the author's most recent inventions in prepayment gas-meters was described in the "Journal" for April 14, p. 94.]

WIDNES GAS AND WATER WORKS.

At a District Meeting of the Association of Municipal and County Engineers, held at Widnes and Runcorn on the 18th inst. under the presidency of Mr. W. Weaver, M.Inst.C.E., the Borough Engineer and Surveyor of Kensington, Mr. Isaac Carr, M.Inst.C.E., the Gas and Water Engineer of the Widnes Corporation, read the following paper on the two undertakings of which he has charge.

The Widnes Gas and Water Works were founded by a private Company in 1860, and in 1867 were acquired by the late Local Board, under the special provisions of the Widnes Improvement Act of that year. At the time of the transfer, the consumption of gas was 13 million cubic feet, and of water 20 million gallons, per annum. Since the foregoing period, the annual consumption of gas has increased to 250 million cubic feet, and that of water to 1000 million gallons. To meet these increases, large extensions have been made, which bring the capacity of the gas-works up to $1\frac{1}{2}$ million cubic feet per diem, or (say) equal to a consumption of 350 million per annum, and that of the water works to 1400 million gallons per annum.

Gas-Works.

The carbonizing plant at present consists of 308 mouthpieces, capable, as already mentioned, of producing $1\frac{1}{2}$ million cubic feet of gas per diem. Of the above number, 140 are in one retort-house, and in settings of sevens, fired by the regenerator system. The new plant, recently inaugurated, commences with the condensers. The first is a slow-speed atmospheric condenser, consisting of a 30-inch pipe, 103 feet long, laid in a brick trough below the yard level, and covered with iron plates; provision being made for a current of air (the quantity of which can be regulated) to be drawn through. From this, the gas enters a second condenser of the water-cooled type, which is constructed on the general principle of this class of apparatus.

The exhausting plant comprises two combined horizontal engines and rotative exhausters; their capacities being 40,000 and 80,000 cubic feet per hour respectively. Steam is supplied from boilers fitted with patent force-draught furnaces for the consumption of breeze and refuse fuel; and for additional efficiency, the boiler feed-water is heated to boiling point on its way to the boilers by the exhaust steam from the engines in a Berryman patent water-heater.

From the exhausters, the gas passes through a Livesey washer into the scrubbers. These are 12 feet in diameter and 58 feet high; the total height being 78 feet. The filling consists of canvas screens. A notable feature in connection with them is that the 12-feet rings of the body are cast in one complete piece, each 5 feet deep, instead of in segments; thus forming an enormous casting—so large that it could not be conveyed by rail. The Contractors, the Widnes Foundry Company, were enabled to carry out the work as described owing to the proximity of their works; the advantages being that the scrubbers are neater looking through having fewer joints, and the cost of erecting was considerably less.

While speaking of scrubbers, I cannot allow the opportunity to pass of claiming the inventor of the scrubber or its prototype as a Widnes gentleman (*vide* "King's Treatise on Coal Gas"). In 1836, the late Mr. William Gossage, the founder of the firm of Messrs. William Gossage and Sons, soap-works, Widnes, invented the scrubber as part of an apparatus used by him in the decomposition of common salt. This apparatus was copied by gas engineers; and to-day it forms one of the most important and remunerative adjuncts to the purifying plant in gas-works throughout the whole world.

The purifiers are six in number, 20 feet square and 6 feet deep, all of which work with oxide. Revivification of the oxide *in situ* is effected by the injection of steam and air at the centre-valve inlet. There are in course of construction two additional purifiers of the luteless type, 30 ft. by 25 ft. by 5 ft.

The station-meter house contains two meters, of 45,000 and 25,000 cubic feet per hour capacity respectively; also two 14-inch station governors supplying different levels of the district. The whole of the valves and connections throughout the works are 16 inches in diameter.

Extensive storage accommodation for tar and ammoniacal liquor has been provided by converting an old gasholder tank, 53 feet in diameter and 20 feet deep, into two separate wells—one for tar and one for liquor—having a total capacity of 700 tons. The wells are covered with a strong roof in rolled steel joists and concrete, supported from the under side with a brick cross wall, built in hydraulic mortar. The covering of this tank has effected a valuable increase in the yard space at a point where additional room was greatly needed. The tar and liquor flowing from various points in the works are passed through a separator, from which they overflow to their respective wells. A special feature in the tar-well is that the bottom is formed in an inclined plane falling to the pump suction, which is a permanent fixture at the bottom of a sump-hole. The advantage is that the heavy tar gravitates to the suction, and is pumped on first; and thus all the tar and the whole of the well-space is kept available. With the old arrangement of a flat bottom well and a movable suction pipe, thick tar, which sometimes cannot be pumped, accumulates in such quantities as to cause serious inconvenience through the reduction of the storage capacity, to say nothing of the practical loss of the tar.

The tar and liquor pump-house is surmounted by a cast-iron tank of 25 tons capacity, into which tar is pumped for the filling of railway tank-waggons with the greatest possible despatch.

The sulphate-house is spacious; storage for 100 tons of sulphate being provided. The capacity of the plant is 1½ tons of sulphate per diem. The saturator is fitted with a Wilton discharger. Oxide of iron purifiers of ample capacity are provided for absorbing the waste gases.

On one side of the boiler-house is erected a large mortar mill for grinding the retort-house ashes into mortar. The ashes are somewhat costly to dispose of, yet when converted into mortar find a ready sale to the various building contractors in the town, and at the same time form an additional and a profitable source of revenue.

Railway siding accommodation is provided throughout the works. The workshops, stores, testing-rooms, and offices are light, commodious, and well ventilated.

There is one gasholder of 100,000 cubic feet capacity remaining on the gas-works site (three small ones having been previously removed); and this is shortly to be taken down to provide additional yard and coke storage space.

The gasholder storage station is situated in Ditton, outside the borough boundary, and 1½ miles from the gas-works. Here is an ordinary two-lift holder of 400,000 cubic feet capacity, and also a three-lift Gadd and Mason patent columnless holder of 700,000 cubic feet capacity, erected in 1893. The tank is 118 feet in diameter by 24 feet deep; and the holder, when fully extended, rises to a height of 72 feet. The total storage capacity, including the holder at the gas-works, is 1,200,000 cubic feet. There is a 12-inch governor and check meter at this station, for supplying gas to the Ditton, Halebank, and Hale districts. Sufficient land has been acquired at the Ditton site for the erection of additional works of 1½ million cubic feet capacity per diem.

The total number of consumers is 5822, of whom 3745 use "penny-in-the-slot" meters. The selling prices of gas within the borough are 1s. 4d. and 1s. 2d., and for motive power purposes 1s. per 1000 cubic feet net. Consumers of gas by slot or prepayment meter are allowed 40 cubic feet per penny, which includes service meter, internal pipes and fittings, with boiling burner, also the continual maintenance of same.

The illuminating power of the gas is maintained at 18 candles, notwithstanding the fact that the statutory standard is but 14 candles, as it is, in the opinion of the writer, much to the advantage of the consumer to supply gas of what may be termed an economical quality. In other words, had the present low selling prices been obtained by reducing the quality, the consumer could not be said to have been the gainer.

The prices charged are lower than those of any other gas authority in the world. With regard to the price of 1s. per 1000 cubic feet for motive power purposes, it is interesting to note that this gas, which has a calorific value of 670 B.T.U., is 25 per cent. cheaper than Mond power gas at 3d. per 1000 feet. Widnes gas, at 1s. per 1000 cubic feet, develops 5½ brake horse power in a modern gas-engine for 1d., or (say) 0·18d. per brake horse power—a price considerably below that of a high-duty steam-engine, especially when costs of steam generating are included. Electricity also for power purposes, to be comparable with gas at the Widnes price, must be sold at ¼d. per unit.

The gas undertaking contributes to the relief of the general district rate of the borough by doing the whole of the public lighting free of cost, which amounts to a charge of almost 2d. per 1000 cubic feet on the gas sold.

The total capital expended on the gas-works, including the original purchase money, up to the 25th of March last, was £102,223, of which sum £30,057 has been paid off through the sinking fund and the profit and loss account; leaving the actual capital £72,166, or equal to £2 17s. per ton of coal carbonized.

Water-Works.

The water-works consists of two pumping-stations—one being situated in Ditton, and known as Stocks Well, and the other in Little Woolton, and known as Netherley. The former is some 3 miles, and the latter 5½ miles, from the Town Hall, Widnes. There are also two service reservoirs on Pex Hill, the highest ground in the district, being 218 feet above the level of the Mersey, and 193 feet above the works district—thus affording an excellent pressure of water throughout the town. The water is obtained from deep wells and bore-holes sunk into the new red sandstone formation. The distance of the reservoir station from the town hall is 2¾ miles.

Stocks Well is the old station; the first portion having been erected in 1868. Some old plant, consisting of a pair of 50-horse power double-acting beam condensing engines, with a capacity of 1 million gallons per diem, has been discarded. These engines formerly pumped from a well 10 feet in diameter and 60 feet deep. From the bottom of this well, a 14-inch bore-hole is sunk a further depth of 440 feet. This second well and machinery were put down in 1875; the well being 10 feet in diameter, and 62 feet deep, with a 24-inch bore-hole carried down a further depth of 250 feet. The engine is a single-acting condensing engine of the Bull Cornish type, and of 150-horse power. The pumps formerly were on the bucket-and-plunger principle, and pumped the water from the well; but in 1886, owing to the water having ceased to rise into the well in sufficient quantity, a new open-lift double-bucket pump was fixed in the bore-hole, with the suction 90 feet down. The result of this alteration was that the yield of the well, which had fallen to 600,000 gallons per diem, was increased 1½ millions. The total height the water is lifted to the reservoirs is 250 feet. The steam for the engines is supplied by three 30 feet by 7 feet Lancashire boilers.

A dangerous but interesting feature at this station is that the red sandstone through which the wells and bore-holes are sunk is of an exceedingly soft nature. Sand is continually coming up with the water; and great difficulty has for years past been experienced owing to the subsidence of the wells from this cause. More especially does this apply to the well above alluded to; and at the end of 1895, so serious did this become, that it was not considered safe to continue working the engine. The nature of the subsidence was that about 30 feet of the bottom portion of the well, upon which the pumps should rest, had broken away, and bodily settled down a distance of 4 feet, fortunately leaving the upper portion, which carries the engines and buildings, standing firm.

What was actually happening was that the foundations were being continually pumped away. Hundreds of tons of sand have been thus brought out, leaving behind the well-casing enormous cavities, which have from time to time been filled in with concrete. However, the difficulty was overcome by a scheme which consisted of widening the 24-inch bore-hole to 36 inches for such a distance down until rock was found sufficiently hard to carry a permanent foundation. Hard rock was met with at 86 feet below the well bottom, or 152 feet below the ground level; and upon the shoulder formed by the widening has been placed a 30-inch cast-iron cylinder, which is carried up to stand 10 feet above the bottom of the well. The lower portion of the cylinder is perforated, so as not to interfere with the inflow of water to the bore-hole pump. The upper part is solid, and the space between the upper outer portion of the cylinder and the rock is filled in with concrete, which is carried up under and inside the well-casing to the level of the top of the cylinder. It is now eight years since the work was completed, and so far it has remained a permanent and immovable foundation.

It is proposed to duplicate the plant at the Stocks Well station with a pump on the lines of the new one at Netherley. The capacity will be 3 million gallons per diem, and the estimated cost £12,500, including new high-pressure steel boilers.

The Netherley station was acquired in 1875, when an oval well, 12 ft. by 9 ft., and 100 ft. deep, and a 24-inch bore-hole for a further 200 feet were sunk. The well is surmounted by a 150-horse power single-acting condensing engine of the Bull Cornish type, similar to the one described at Stocks Well, and capable of pumping 1¼ million gallons per diem. The pump consists of an open-lift well pump, discharging into an open cistern at the top of the well, in which cistern the plunger or force-pump sits, and forces the water to the reservoirs, a distance of about five miles, with a total lift of 270 feet.

In 1892-3, to meet the increasing demand for water, a second pump of 2¾ million gallons capacity per diem was put down. To avoid the enormous cost of sinking a well for the accommodation of a pump of so large a capacity, it was arranged to sink bore-holes from the surface, and adapt the pumps to suit. Two bore-holes, 30 inches in diameter and 20 feet apart, were sunk to a depth of 200 feet to hold the pumps, and were carried down 18 inches in diameter for a further depth of 200 feet in one bore-hole and 400 feet in the other—making the total depth of the two 1000 feet. The bore-holes are cased with cast-iron tubes for a distance of 35 feet down, at which point the rock was found sufficiently hard to be self-supporting. The estimated total saving

in capital outlay in substituting the bore-holes for the well is £15,000. The estimate is based on the cost of the well already on the site.

The engine, which was built by Messrs. Hathorn, Davey, and Co., of Leeds, is of the horizontal direct-acting compound type, having 32-inch and 60-inch cylinders, and 6 ft. 3 in. stroke. It works two sets of pumps, a pair of 18½-inch diameter and 6 ft. 6 in. stroke open lift-pumps in the bore-holes; the sections being 200 feet down. The water from the bore-hole pumps is delivered into a tank under the engine-house floor, from which a double-acting piston force pump, 18½ inches in diameter and 6 ft. 3 in. stroke, takes the water, and forces it to the reservoirs—a total rise, including friction head, of 361 feet. The engine was required by the Corporation to do a duty of 90 million foot-pounds on 112 lbs. of coal, or an evaporation of 9 lbs. of water per pound of coal. The penalty of the contract was £50 per million for each million below the specified 90; while a premium of £25 per million was offered for each million by which the duty should exceed that specified. The average result of the tests, extending over a period of three days, was 109·6 millions—one of the highest duties ever obtained from engines of this type. The premium earned amounted to £475.

The total cost of the scheme, including the bore-holes, the foundations, engines, pumps, buildings, and premium, was £10,450. This works out to the extraordinary low capital cost of 2·5d. per 1000 gallons of water pumped per annum, which is claimed to be a record, taking all comparative circumstances into consideration. The total pumping capacity of the station is 4 million gallons per diem. The steam is supplied from four Lancashire boilers, 26 feet long and 6 ft. 6 in. in diameter. This station, including the four workmen's cottages, is lighted throughout by electricity generated on the works.

Both stations are noted for the purity of the water and the abundance of the supply. The average total hardness, being under 6 per cent., renders it a highly suitable water for manufacturing and general domestic purposes. The consumption last year, as has been previously stated, was 1000 million gallons, which amounts to 80 gallons per head per diem, 60 gallons of which are registered through meters for manufacturing purposes.

The Corporation are the possessors of a site for a third pumping-station, known as Belle Vale, situated a mile beyond Netherley, and six miles from Widnes. A 3-inch bore-hole is sunk a depth of 300 feet, from which a stream of 2500 gallons per hour flows continually all the year round.

The two covered service reservoirs on Pex Hill will hold, when full, 12¼ million gallons—the old one 1¼ millions, and the new one 11 millions. The latter, at the time it was made, was the largest covered reservoir ever built. The small reservoir is constructed of brick wall, and rendered watertight with puddle backing. The large reservoir is built with the red sandstone excavated on the site, and made watertight by a lining of asphalte, which is run in the outer walls and returned under the floor. The roofs of both reservoirs are constructed with 9-inch brick-arches, asphalted over, and covered up level with earth.

The present resources of Widnes as regards its water supply, if all three stations were worked to their maximum capacity, are estimated at 3000 million gallons per annum—a quantity sufficient to supply a town of 260,000 inhabitants with 30 gallons per head per diem.

The selling price of water by meter for manufacturing purposes is 4½d., 3¾d. and 2d. per 1000 gallons net for varying quantities. The net charge for domestic purposes is 4½ and 4¾ per cent. on the rateable value, inclusive of baths and water-closets.

The total capital expended on the water-works, including the original purchase money, up to the 25th of March last, was £177,108, of which £18,903 has been paid off through the sinking fund and the profit and loss account—leaving the actual indebtedness £158,205.

At the close of the paper, a vote of thanks to the author was proposed by Mr. Farrington, of Llandudno. He thought it would be of very great interest to the members of the Association if they could hear from Mr. Carr his reason for the excellent results he had obtained. Mr. Brownridge (Birkenhead), in seconding the motion, said the results Mr. Carr had shown in his paper did very great credit to him, and were no doubt of benefit to the town of Widnes. The motion having been adopted, Mr. Carr thanked the members heartily for the kind way in which they had spoken of his paper, which, he said, was purely of a descriptive kind. He scarcely knew how to touch the subject for an Association such as theirs, most of the members not being directly interested in gas manufacture. His works had attracted a good deal of attention up and down the country. Personally, he regarded the result obtained as an example of what might be achieved by municipalization.

Gaslight and Coke Company's Dividend.—We learn from the Secretary and General Manager of the above-named Company (Mr. John W. Field) that the accounts for the past half year show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance of £116,530. This result compares with a distribution at the rate of £4 per annum for the June half of 1902, with a balance carried forward of £68,165.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

Annual Meeting at Bolton.

The members of the Association held their annual meeting last week at Bolton, under the presidency of Mr. R. H. SWINDLEHURST, M.Inst.C.E., the Corporation Water-Works Engineer, who was supported, with extreme generosity, by the Mayor of Bolton (Alderman John Miles, J.P.), who is better known to the engineers of the gas industry than to water-works engineers. The proceedings commenced on Tuesday morning in the Council Chamber at the Town Hall, which had been kindly placed at the disposal of the Association for the meetings by the Mayor and Council. The members having assembled,

Alderman MILES, wearing his chain of office, and standing in his customary place as the chief representative of the borough, said he understood that this was the first visit of the Association to Bolton; and, in now coming there, it was his pleasure and privilege to extend to the members as hearty a welcome as it was in the power of a Lancashire man to bestow. He could assure them that the Council were very proud indeed to think that they were honouring not only the town of Bolton, but their Water Engineer as well—as they had already done, by electing him to be their President. He felt that, in the selection of Mr. Swindlehurst as President, the members would have no cause to regret their choice. From a long knowledge of him, having been a party to his appointment as Water Engineer to the borough many years ago, he knew him to be a man of very great worth. He was at the same time a man of few words; but nevertheless he was a man of excellent deeds. The work he had done had not only been an advantage to the borough, but it had been done to the satisfaction of his Committee and of the Town Council. The Council were very proud of their undertakings; and there was not one they had the honour of carrying out for the benefit of the ratepayers that they appreciated or valued more highly than the water-works. He believed the members would find they were a very complete water-works, and a credit to the town, and they showed that the Corporation had not been slow in fulfilling the duties that were entailed upon them in providing an abundant supply of good water for the inhabitants. Having expressed the hope that the weather would be favourable during the week, his Worship concluded with the heartiest possible welcome on his own behalf and that of the Town Council and the inhabitants.

Mr. WILLIAM WATTS (in the temporary absence of the retiring President, Mr. F. Griffith, of Leicester) thanked his Worship very heartily for his reception; and his words were enthusiastically endorsed by the members.

Alderman MILES, in the course of his response, said he was a member of a kindred Association, and had been for the last 38 years. He referred to the Institution of Gas Engineers; and he believed he had attended some 36 or 37 of their meetings. Consequently, it gave him more pleasure than it would otherwise have done in tendering the members this welcome to the town. He knew, because of his long experience, the benefit of meetings of this kind.

The SECRETARY (Mr. Percy Griffith) then read the minutes of the winter meeting held on Dec. 6; and they were confirmed.

THE NEW PRESIDENT.

Mr. WATTS said it was his pleasing duty to introduce to the members their new President and old friend Mr. Swindlehurst. They all knew that he had a cool head and a kindly heart, and that he had done all he could to give the Association a hearty welcome to Bolton. He (the Chairman) was speaking the feeling of the members when he said that he was certain, during Mr. Swindlehurst's year of office, he would do all he could to advance the interests of the Association. As his Worship had said, their President was not a man of many words. He believed in "the feast of reason" rather than in "the flow of soul." If they had more men of this type, they would have less booming in the country, and probably more and better work done. He asked Mr. Swindlehurst to assume possession of his office; and he wished him hearty success in, and health and happiness to enjoy, the year before him.

On taking the chair, Mr. Swindlehurst had a very enthusiastic reception.

THE LATE PRESIDENT.

The PRESIDENT said his first duty was to propose a hearty vote of thanks to the retiring President, Mr. Frederick Griffith. No man could have performed the duties of the office in a more courteous and able manner than he had done.

Mr. WILLIAM MATTHEWS said the kindness and hospitality with which the President of last year treated them on the occasion of the annual meeting at Leicester must have impressed every one of the members; and for that, and for what Mr. Griffith had done for them professionally and personally during the year, they had to thank him. He seconded the motion with great pleasure.

The proposition was cordially agreed to.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address. It may be said to divide itself into two parts—the first being general in character, and the second the direct result of the President's professional studies. The former may be conveniently summarized, and the latter given *in extenso*.

Very sincerely the President acknowledged the honour done him by the members, which honour he accepted rather as a tribute to the importance of the borough he represented than to any merit of his own. Commenting on the progress of the Association, he pointed to the roll of membership. In 1901, the total of all classes was 230; in 1902, 262; and in 1903, 286. Passing from this subject to that of Water Boards, he alluded to the deputation which waited upon the President of the Local Government Board in October last. Several members of the Water Boards Committee of the Association attended the deputation as delegates; and the views of the Association on the subject of the control of water undertakings throughout the country, and the amendments required in the general water-works laws, were duly laid before Mr. Long by Mr. Matthews and the Secretary. In the reply to the deputation, the points brought forward by the various delegates were very sympathetically received by Mr. Long, who suggested that many of them might be effectually dealt with by the Royal Commission on the Treatment and Disposal of Sewage, then sitting, to which body he undertook to present them for consideration. Since then a third report has been published by the Commission; and he (the President) was sure it would be a source of gratification to the members to know that this report included several recommendations coincident with the views expressed by the Committee at the deputation. The most important of these relates to the formation of a new central authority under the control of the Local Government Board, to whom all questions of the pollution of rivers and other sources of water supply will be referred; and among the permanent officers to be attached to the new authority are included a bacteriologist, a chemist, and an engineer, each of whom is to have a special knowledge of water supply. In addition to this new central authority, the Royal Commission recommend the creation of Rivers Boards; the areas of control being the principal watersheds throughout the country, and the duties of which would include the supervision of all water undertakings within their respective districts. A comparison between the terms of the report and the report of the Water Boards Committee presented in 1900 proves that the Association have exerted a very powerful influence upon the views of the Royal Commission, and that the most important points for which the members have contended have now been placed before Parliament in such a form as, it is trusted, will secure for them the early attention of the Legislature. There are, however, other points which it is felt ought to receive consideration, and a resolution on this subject will probably be submitted to the members on some future occasion.

The work and usefulness of the Association next claimed attention; and this naturally led to a consideration of the duties and responsibilities of the water-works engineer, which it is undeniable, if carried out aright, have a most important bearing upon the improvement of the health and prosperity of the people. To competently discharge the duties of his office, the water-works engineer must have a suitable training. It is, said the President, unnecessary to emphasize the claims of theoretical or technical instruction, the necessity for which has already been realized, and to a large extent supplied. At school or college, the youth has only to desire knowledge to acquire it; but the training essential to an engineer must be gained afterwards by persistent effort on the part of the student. No amount of lecturing will make him proficient in practical work; and no accurate or useful knowledge of the nature of materials can be gained other than by handling them. Having enlarged on this point, the President emphasized the fact that the responsibility of the water-works engineer is also great. Very arduous and difficult duties are placed upon him. He has in some cases almost uncontrolled command of money. He is often called upon to act as arbitrator in disputes between employer and employed. His integrity, honesty, and independence must, therefore, be above suspicion. His judgment should be sound, and such as will command the greatest respect; and, although it may take a long time to earn such a reputation for ability, fairness, and integrity as will merit the full confidence of those with and for whom he works, it should be the chief aim of every engineer to secure it.

Passing from the engineer to the authority and the community to whom his services are devoted, the duty of the former is simple and definite—viz., to carry out the duties imposed by the various Acts which have for their object the improvement of the health and comfort of the people; and to this end and no other should the members of every water authority devote their energies. Statistics clearly show that the expenditure on the improvement of the water supply in the larger towns has resulted in a saving to the community; and, in fact, no one can fully estimate the benefits conferred on our large and crowded centres of population by the introduction of a pure and abundant water supply. In spite of this, the difficulties and opposition met with when such schemes are mooted are often very serious; and the originators are frequently subjected to all sorts of criticism and even misrepresentation. The public need to be shown that money expended on such works is a good investment, and that it is to their own interest that the works should be of the best and most perfect description. Moreover, as, by their nature, such undertakings must necessarily be costly, it is the duty of the responsible authority to obtain the best advice in carrying them out; for it is obviously better to spend a few hundred pounds in fees and salaries than to spend thousands on imperfect works designed by insufficiently remunerated and incompetent advisers. There are, of course, many municipalities who fully realize the importance of the situation, and who have spent, and are spending, large sums of money on their water supply in such a manner as bears witness alike to the foresight and enterprise of their advisers.

Turning now to the subject to which his professional studies have been devoted for a period of more than 27 years—viz., rainfall, and the proportion which flows off the ground—the President said: One of the greatest authorities on this subject (Dr. Miller) concludes that the maximum density of the rain cloud occurs at about 2000 feet above sea level; and from this the conclusion may be drawn that the rainfall will increase proportionately to the elevation up to 2000 feet, and will decrease at elevations beyond this. Another conclusion which may be drawn from Dr. Miller's observations is that in a range of mountains which exceeds 2000 feet in height, the greatest deposition of rain may be expected on that side of the mountain upon which the rain clouds impinge; and, similarly, that in ranges of mountains or hills of a less height than 2000 feet the rain clouds will be driven over the summits, and will produce rainfall on that side of the mountain which is protected from the winds—that is, on the opposite side to that upon which the rain clouds first impinge. The Rivington works of the Liverpool Corporation afford a good illustration of this. The Rivington Hills form the first high ground to the east of Liverpool. They do not exceed 1700 feet in height, and the average rainfall on the west side during 22 years (from 1878 to 1899 inclusive) was 42·78 inches; whereas the average rainfall on the Belmont watershed of the Bolton Water-Works, which lies on the east of these hills, and in the first trough beyond the summit of the most westerly hills, for the 60 years 1843-1902, was 56·493 inches. In the Entwistle Valley, which forms the next trough, the rainfall averaged 52·67 inches during the 35 years from 1868 to 1902 inclusive. These remarks will suffice to show how much the rainfall varies in the same district. Nothing, therefore, is more fallacious than to attempt to estimate by inference from other districts the amount of rain that will fall on any given area. Only extended observation and powers of judgment acquired by experience can enable an engineer to form an accurate estimate of the probable rainfall on any particular gathering-ground.

We now come to the question of the proportion of the rainfall which will flow off the surface of the drainage area. Of course, geological conditions largely affect the consideration of this question; but the elevation and declivity of the land surface, and the nature of the vegetation with which it is covered, have also an important effect upon the result. Thus, in the coal measures and the millstone grit formations, the quantity of spring water will vary from 0·25 cubic foot per second in the driest season to 0·75 cubic foot per second (or an average of about 0·5 cubic foot per second) per 1000 acres for a dry season. I made careful observations upon this point at the Entwistle watershed in 1887 (which was a season of drought), when I found the quantity of water flowing into the reservoirs, which receive the drainage of 2137 acres during 24 hours (July 22), averaged 0·074 cubic foot per second per 1000 acres. I may say that this was the longest season of drought recorded in connection with the Bolton Water-Works. It commenced on Feb. 9 and continued until Aug. 31, or a total of 203 days; and, making an allowance for occasional rain, amounting altogether to about 200 million gallons during the period, the net duration of dry weather was 170 days. I have also taken observations for 24 years at Belmont, and found that the quantity of water which flowed off the ground averaged 40·103 inches per annum out of a total rainfall of 56·97 inches per annum—thus showing a loss of 16·87 inches. At Heaton, for the same period, the quantity of water flowing off the ground averaged 27·195 inches per annum, out of a total average rainfall of 39·85 inches—showing a loss of 12·66 inches. At Entwistle, during the same period, the quantity of water flowing off the ground was 34·58 inches out of 51·54 inches—showing a loss of 16·96 inches. The rain-gauges from which these results were obtained are placed as follows: That at Belmont, near the valve-man's cottage, 800 feet above Ordnance datum; that at Heaton, on the reservoir embankment, 523 feet above Ordnance datum; and that at Entwistle, near the valve-house, 700 feet above Ordnance datum. These gauges probably showed a less amount of rain than actually fell on the whole of the drainage areas, but not having gauges on the top of the hills, the actual results cannot be given here.

The purity of any water supply is, or ought to be, considered a matter of the very first importance. It is needless to dilate on the bad effects of an impure water supply. It not only raises the death-rate, but causes trouble and misery untold. Rain-water itself is by no means free from impurities—soot, dust, and other solid matters in the air being brought down by it; and unless the receptacles in which it is collected are frequently cleaned, it is very liable to become a source of contamination. Even water collected from rocky mountains or heather-clad hills, although it may appear to be very clear and pure, is all the better for filtering. The water supply of Glasgow from Loch Katrine is unfiltered, as is also the supply to Manchester from Longdendale and Lake Thirlmere, as well as other large public supplies; but

it is probable that, in course of time, it will be considered necessary to filter all classes of water unless natural filtration of an effective nature is available. The impurities which it is desirable to remove are of the following different forms—viz.: (1) leaves, &c., floating on the surface of the water; (2) matter in suspension, consisting of earthy detritus, minute vegetable growth, and living organisms of various kinds; (3) bacteria; and (4) impurities in solution.

The first of these is comparatively easy to get rid of, the overflow or bye-wash automatically removing all floating matter when the reservoir is above overflow level. Matter in suspension is not, however, so easy to get rid of. It is at all times desirable to exclude the first flush of flood water, as this is invariably impregnated with sand, silt, &c. The Bolton works are not, however, constructed to exclude flood water; but I find little difficulty in dealing with it, as it undergoes purification by subsidence in the large reservoirs, and this is, of course, completed in the process of filtration. I do not consider it a good practice to provide separate drainage areas for compensation water, as is the case at my own works, as this makes it much more difficult to provide for the disposal of flood water.

Impurities in solution are naturally the most difficult to get rid of, as filtration is primarily only a mechanical method of straining through a fine sieve, consisting of a layer of sand. Recent research has, however, shown that filtration under proper conditions does more than simply strain the water, acting to some extent as an oxidizing agent, which not only reduces the number of micro-organisms present in the water, but renders harmless the organic matter in solution. On this account, it is important that the speed of filtration should not be excessive. The acidity and plumbo-solvent ability of water collected from gathering-grounds of a peaty nature can be effectually neutralized by either adding powdered carbonate of lime or passing the water through a layer of limestone chippings. The latter has proved very successful at the Dingle filter-beds. Exposure of the water to the atmosphere is also a valuable aid to purification, especially when the water is allowed to flow down a series of steps or miniature water-falls, as by this means such gases as sulphuretted hydrogen are allowed to escape, and any ferruginous matter is precipitated. In fact, it must be admitted that aëration in the presence of sunlight is one of Nature's great purifying agents. Of course, natural filtration through permeable strata is best when it can be obtained; but, for artificial filtration on a large scale, experience has taught us that sand filters form the most effective means of purification from suspended matter, as well as from bacteria and dissolved organic matter. Recent research has shown the efficiency of a filter to depend upon the vegetable growth containing enormous numbers of bacteria, which forms on the surface of the sand after it has been in action for a short time; and when in its most perfect condition, a filter will remove nearly the whole of the bacteria in the original supply.

In practice, I find the proper rate of filtration to be between 8 feet and 12 feet depth of water passed per 24 hours; and in modern well-constructed works, a speed of 4 inches per hour is not exceeded. Thus, an area of one square foot will pass 8 cubic feet per day, or 50 gallons; and with a consumption of 25 gallons per head per day, this represents a filter area of 0·5 square foot per head of population. As the most important part of the filtering process is effected by the thin layer of scum which forms on the surface of the sand, it is not safe to use the water until this fine surface layer is formed. Hence it is essential that the water should be allowed to settle for twelve hours or so on the surface of the sand whenever a filter has been cleaned. A filter will run from a week to two months without cleaning, according to the state of the unfiltered water; and when a filter gets choked, and will not pass the required quantity of water, a layer of about $\frac{1}{2}$ inch or less in thickness is skimmed off, and the filter is set to work again—this process being repeated till the sand is reduced to about 1 foot in thickness. The remaining sand in the filter should then be furrowed, to allow of aëration; and after the filter has been made up to its original depth with clean washed sand, it may be set to work again. The sand taken from a filter is all the better for lying some time, so that it may get thoroughly aërated. Although it is true that water-works engineers succeeded in making good and effective filter-beds long before they knew anything at all about microbes, it must be admitted by us all that recent researches in the domain of the bacteriologist have helped the engineer to a better and more thorough knowledge of what he is about, and have emphasized, in a remarkable manner, the necessity of filtration being carried out in an intelligent, a systematic, and a scientific manner.

At the close of the address,

Mr. WATTS moved a hearty vote of thanks to the President for his excellent and practical deliverance. Some of the points, he remarked, were probably open to a little discussion; but the references to rainfall were really very valuable. He might say he had himself been going into this subject, and had prepared some diagrams to illustrate it; and they bore out the President's views.

Mr. C. H. PRIESTLEY (Cardiff), in seconding, had much pleasure in testifying to the wise remarks the President had made as to the subject of filtration generally.

The motion was unanimously carried; and the President briefly replied.

NEW MEMBERS AND ASSOCIATES.

The Scrutineers (Mr. F. W. Lillicrap, of Devonport, and Mr. A. J. Price, of Lytham) reported that the ballot had resulted in the election of the whole of the gentlemen nominated as members and associates. The list is as follows:—

Members.—Mr. P. Anderson, of Sutton; Mr. J. C. Barrowclough, of Batley; Mr. Easton Devonshire, of Chislehurst; Mr. F. J. Finglah, of Carmarthen; Mr. W. Vaux Graham, of Westminster; Mr. H. C. Mitchell, of Hindhead; Mr. W. Phelps, of Wells, Somerset; Mr. J. W. Rawden, of Morley; and Mr. U. A. Smith, of Westminster.

Associates.—Mr. R. Blakiston, of Liverpool; Mr. H. T. Davey, of Devonport; Mr. H. Lapworth, of the Derwent Valley Water-Works; Mr. W. R. Locke, of Hemel Hempstead; and Mr. J. Price, of London.

Mr. J. R. Downes (Redhill) and Mr. George Gooch (Westminster) were elected Hon. Auditors for the ensuing year.

PAPERS AND DISCUSSIONS.

The remainder of the sitting on Tuesday and the whole of the sittings on Wednesday and Thursday were devoted to the reading and discussion of the papers. They were taken in the following order:—

Tuesday.—(1) "Protection and Straining *v.* Land Filtration for Dealing with Upland Surface Waters." By Professor DELÉPINE, M.B., B.Sc., Director of Public Health Laboratory, Owens College.

Wednesday.—(2) "The Raising of Water from Deep Wells and Borings by Compressed Air." By Mr. W. H. MAXWELL, of Tunbridge Wells. (3) Notes on the Geology and Underground Water Supply of South Lincolnshire." By Mr. HENRY PRESTON, F.G.S.

Thursday.—(4) "The Internal Combustion Engine as a Pumping Medium." By D. HASTINGS IRWIN. (5) "Description of a New Pipe-Cleaner." By Mr. C. CLEMESHA SMITH, of Wakefield.

[Abstracts of the papers and discussions will be published in succeeding issues of the "JOURNAL."]

STANDARDIZATION OF CAST-IRON WATER-PIPES.

At the opening of the sitting on Wednesday, the final report of the Committee on the standardization of cast-iron pipes was submitted. The principal parts were as follows:—

Acting on the instructions expressed in a resolution of the Council passed at your meeting on March 21 last, we have carefully considered all the information, data, and opinions collected since the issue of our interim report, dated July, 1902, and are now prepared to submit our final report upon the matter referred to us.

Interim Report.—Our interim report will, we think, have conclusively shown that the general feeling of water-works engineers and pipe-founders is favourable to the standardization of cast-iron pipes, subject only to some difference of opinion as to the limits within which standardization should be confined. The discussion on the report which took place at our annual general meeting at Leicester last year, fully confirmed this view; and the feeling of the manufacturers was clearly put by the representative of a firm of pipe founders, who stated that: "Speaking from the manufacturers' point of view, he might say that they had discussed the question of standardization a great deal lately; and he believed they were unanimous in desiring to carry out any standardization which might be decided upon, and to stock such patterns as might be approved."

External and Internal Diameter.—The suggestion that standards should be based upon the external diameter rather than the internal, in order that all sockets for any given size should be interchangeable for different classes of strength or weight, was favourably commented upon; and in our opinion should be carefully considered in any scheme of standardization.

Coating, &c.—Limited Number of Patterns.—The method of coating pipes with composition and other details affecting the manufacture were also discussed; and it appeared to be the general opinion that, in order to secure the universal adoption of any given standards, it would be desirable to limit the number of sizes standardized to those in common use in this country—as, for example, diameters from 3 to 18 inches—and the number of classes for each size to three or less. With this opinion we are disposed to agree. The subject of coating cast-iron pipes was further considered at the winter meeting in December, when a paper dealing with this point was read by Mr. W. H. Humphreys, of York, and a very interesting discussion ensued. Generally it was admitted that greater uniformity should be observed in the mixing of the composition and in the method of dipping the pipes; and we are decidedly of the opinion that these points should be included in any scheme of standardization.

Form of Joint.—Several engineers have expressed a very strong opinion that in standardizing cast-iron pipes for water-works purposes, special attention should be given to the design of sockets for lead joints without yarn of any description, as well as to "turned-and-bored joints;" and if these alternatives can be included without unduly increasing the number of standard patterns, we are of the opinion that they should be standardized. There is no doubt that yarn is a source of danger in water-mains, especially with certain classes of water; and every facility should be afforded to water engineers to avoid the use of it as far as possible.

Stocking of Standard Patterns.—On the other hand, we feel that one of the advantages to be gained from standardization is the stocking of standard patterns by the manufacturers, by which the cost of manufacture would be reduced, and deliveries could be obtained with greater dispatch than is now the case. With this in view, we think that the number of patterns standardized should be kept as low as is reasonably

possible. There is no doubt that, whatever the number of patterns standardized, cases will arise where different designs will be required either for special purposes or to suit the peculiar opinions of different engineers; and we therefore consider that it will be out of the question to attempt the standardization of pipes suitable for all cases.

Standard Length.—The question of adopting a standard length of 12 feet for all diameters is also an important one; and although it has been suggested by one of our members that the present standard of 9 feet (laid) is more suitable for use in town streets, the reduced cost of jointing appears to us to warrant the adoption of the 12 feet length for standardization purposes.

Method of Casting.—The casting of pipes vertically or at an angle, and either "socket down" or "socket up," are questions which will require careful consideration, as opinions differ very considerably at the present time; but we are confident that, whichever systems may be adopted by the manufacturers and water engineers after due deliberation, will be readily accepted for general adoption.

Quality of Metal.—One point not mentioned in our interim report is, we think, deserving of special attention—viz., the standardization of the quality of the metal. Although it would be impossible to specify in great detail the chemical composition of the metal owing to the varying characteristics of the ore in different parts of the country, still we consider that the standard specification should embrace reasonable tests of the character and strength of the metal. In our opinion, it would be undesirable to include in the present scheme of standardization either water-works fittings, or, indeed, anything but cast-iron pipes and specials in common use.

Flanges.—Pipe flanges have already been considered by the Institution of Mechanical Engineers; and no doubt arrangements could be made either to adopt the standards recommended by that Institution, or to co-operate with them in regard to this aspect of the question.

Metric System.—We do not consider that the metric system of measurements can be conveniently adopted at the present time in place of our present standards for dimensions and weight. It might, however, be possible and convenient to publish the equivalent dimensions and weights of the metric system in parallel columns with the ordinary English standards.

Standards Committee.—Having now dealt with all the practical points of detail which have been brought before our notice, we beg to state our opinion that the next step to be taken is to refer the whole matter, including the recommendations herein contained, to the Engineering Standards Committee, on which the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Iron and Steel Institute, the Institute of Naval Architects, and the Institution of Electrical Engineers are already represented.

We have received a very cordial invitation to this effect from Mr. Charles Hawksley, Past-President of the Institution of Civil Engineers, who has also suggested that this Committee would, no doubt, be pleased to invite the Association to appoint delegates as members of the Sub-Committee which would be detailed to consider this subject.

Under these circumstances, we recommend that this invitation be cordially accepted, and that our two reports be forwarded to the Secretary of the Standards Committee, with a request for the early consideration of the whole matter, and an undertaking to render the Committee every assistance which they may invite.

The report was signed by Frederick Griffith, President; William Watts, Past-President; H. W. Pearson, M.Inst.C.E.; Baldwin Latham, M.Inst.C.E.; E. Brough Taylor, M.Inst.C.E.; and Reginald E. Middleton, M.Inst.C.E.

Mr. William Watts (Sheffield), in moving the adoption of the report, briefly explained the circumstances which had led to the present position of affairs. He said that in the course of the discussion on the manufacture of cast-iron pipes which took place at the winter meeting 1901, it was very strongly urged, and generally admitted, that cast-iron pipes should be standardized. A Committee was at once appointed by the Council to consider the matter; and this Committee presented to the annual general meeting last year an interim report, upon which an interesting discussion took place. The subject was again brought forward at the last winter meeting, when the question of the coating of pipes was very exhaustively discussed. The present report summarized the principal points brought forward in these discussions; but it did not express any very decided opinions upon matters of detail. The Committee felt satisfied that, if the whole question were referred, as proposed, to the Standards Committee, it would be not only unnecessary, but somewhat discourteous, to attempt to dictate to this body upon any other point than the general desirability of standardizing cast-iron pipes. On the other hand, it was felt that a record of the various suggestions that had been made, and the opinions collected from various sources, would probably be of service to the Standards Committee in further considering the subject; and therefore the final report presented a summary of these without expressing any decided opinion on them. In the course of the Committee's investigations, a considerable amount of information had been collected, including a large number of specifications for pipes in use in various towns, and the reports of the New England Water-Works Association and a Committee of American pipe-founders, both of whom prepared complete schemes for the standardization of cast-iron pipes in America. It was proposed to pass these on to the Standards Committee with the two reports, so that they might have the advantage of all the information the Association had been able to collect. Regarding the Committee's recommendations that the whole question should be referred to the Standards Committee, he did not think he could justify this more conclusively than by reading a letter received from Mr. Hawksley during his year as President of the Institution of Civil Engineers. In the letter, Mr. Hawksley said he had, for many years past, been of opinion that the standardization of cast-iron pipes was desirable, and should be glad to see it brought about. He ventured, however, to think that the desired end could be best secured by placing the matter in the hands of the Engineering Standards Committee, who would, he felt convinced, be prepared also to take up the question of the standardization of cast-iron pipes, in regard to which they would be able to bring to bear the experience already gained in reference to the standardization of rolled sections and locomotives. He (Mr. Watts) was sure they might confidently leave this important question to the Standards Committee as suggested by Mr. Hawksley. He concluded by proposing the adoption of the report.

Mr. F. Griffith (Leicester) seconded the recommendation; and it was unanimously adopted.

Votes of Thanks.

At the close of the discussions on Thursday, a number of votes of thanks were passed. In the first place, on the motion of Mr. William Watts, seconded by Mr. W. Millhouse (Scarborough), the Mayor and Corporation were most heartily thanked for their hospitable reception of the Association, for the use of the Town Hall, and for giving the members the opportunity of inspecting the Corporation Water-Works. The authors of papers submitted to the meeting were next rewarded with the cordial thanks of the members, on the proposition of Mr. W. Matthews, seconded by Mr. F. Griffith. The owners of the local industrial works that had been thrown open to the inspection of the visitors were not overlooked; their kindness being sincerely acknowledged on the motion of Mr. F. J. Bancroft (Hull), seconded by Mr. W. G. Peirce (Richmond). The pleasure of recognizing the services of the Council and officers fell to Mr. H. Preston (Grantham). His motion was seconded by Mr. T. L. Hughes (Wigan), and carried by acclamation. Last, but not least, the President was warmly thanked for the courteous manner in which he had carried out the arrangements for the meeting; and in return he expressed his great appreciation of the support he had received from the members generally. At the same time, he acknowledged (and his remarks were thoroughly endorsed) the great energy and ability that Mr. Percy Griffith throws into his work as Secretary.

With these congratulatory and complimentary votes, the business portion of the proceedings terminated.

Social Events.

At the close of the sitting on Tuesday, the Mayor (Alderman Miles) entertained the President and members to luncheon in his dining-room in the Town Hall. But unfortunately for his guests, a social function of another character demanded his Worship's presence elsewhere; and he had to leave before the conclusion of the luncheon. However, his visitors did not allow him to depart without showing their appreciation of all his goodness to them. In his absence, the toasts were entrusted to Mr. J. T. Cooper, the Deputy-Chairman of the Water Committee; and they included the usual loyal sentiment and the "British Association of Water-Works Engineers." In responding to the latter, the President mentioned that the Association now numbered some 300 members scattered throughout Great Britain and in far parts of the world. The members were responsible for the supply of water to about 12 million people; and the value of the property of which they had charge was about £50,000,000. "The Host" was given by Mr. Frederick Griffith, who spoke of his Worship's unbounded hospitality. In Alderman Miles's absence, the Town Clerk (Mr. R. G. Hinnell) was called upon to reply. In his remarks, in which he did his best to represent his Worship, it transpired that Mr. Hinnell has held his present office nearly 40 years. He believed that Bolton had now every undertaking a municipality could possess; and the borough, in his opinion, stood pre-eminent as regarded the management of such undertakings. They had not cost them anything; and nearly every one of them brought a profit to the rates.

On Wednesday evening, the President entertained the members at a smoking concert at the Swan Hotel. An excellent and varied programme was passed through by specially engaged local artistes; and the entertainment gave much satisfaction.

The big social function of the week—the annual dinner—was held in the Mayor's dining-room at the Town Hall on Wednesday night—this further act of kindness on the part of his Worship adding greatly to the dignity and pleasure of the event. The President presided; and the Mayor, the Deputy-Mayor (Alderman Nicholson), the Deputy-Chairman of the Water Committee, and several of the Borough Officials honoured the Association by their presence. After dinner, the usual toasts were proposed; the speeches being excellent and appropriate to their subjects. Local instrumentalists and songsters contributed in no small measure to the entertainment. It was deeply regretted that the Chairman of the Water Committee (Mr. F. W. Thompson) was unable to be present.

Visits to Works.

As usual, when meeting in a provincial centre, a number of visits had been arranged for the afternoons of each day. After the luncheon on Tuesday, two large examples of local industry were inspected, through the kindness of the proprietors. At

Messrs. Dobson and Barlow's works, the operations involved in the making of spinning machinery were witnessed by the members; and later on at the North End Spinning Mills—which are, we believe, the largest of the kind in Bolton—similar machinery to that seen in course of construction at the first works was shown in operation dealing with the coarser kinds of cotton. Altogether the afternoon was full of interest to the visitors.

During the above visits on Tuesday, the weather was most unpropitious; but Wednesday afternoon was considerably more genial. The morning was far from promising; but by the time the members had equipped themselves early in the afternoon against a continuance of bad weather, the sky brightened up, and a very enjoyable excursion was made by brakes—first to the Heaton reservoir and filter-beds of the Bolton Corporation, and subsequently to the Rivington works of the Liverpool Corporation. *En route*, the High Rid (Bolton) reservoir was passed. After inspecting the Rivington works, the party proceeded to Lever Park adjoining, where tea was served—Mrs. Thompson, wife of the Chairman of the Bolton Water-Works Committee, graciously performing the part of hostess.

A long trip was undertaken the following afternoon, in order to inspect the remaining and principal sections of the Bolton Water-Works. From the Town Hall, the members had an enjoyable drive to the Sweetloves reservoir and filter-beds. Leaving there, they passed the Dingle reservoir and filter-beds and the Springs reservoir on their way to the Belmont compensation reservoir. After a walk across the bank of the reservoir, a further drive brought the visitors to the Entwistle reservoir. Some of the interesting features of the works were inspected; and then very grateful were the members with the tea which the President and Mrs. Swindlehurst had thoughtfully provided. The next stoppage was made at the Wayoh compensation reservoir and filter-beds; and the excursionists arrived at Bolton again soon after seven o'clock—though a little tired, feeling well compensated by the variety of, and interest attaching to, the works they had seen.

In giving this general sketch of the places visited on Wednesday and Thursday, no mention is made of the character of the works inspected. This will better be gathered by giving a few extracts from a comprehensive pamphlet on the Corporation works, written by the President.

The population of the authorized area of supply is 284,000, of which 170,000 are within the county borough limits. The total amount of water distributed during last year averaged 5,813,000 gallons per day; and of this quantity about 371,800 gallons per day are supplied to three adjacent local authorities. The proportionate consumption during the year may be taken at 13·60 gallons per head per day for domestic use, and 7·33 gallons for trade and other purposes; making a total of 20·93 gallons per head per day. The source of supply is the rainfall collected from three drainage areas—viz., the Belmont gathering ground, with an area of 600 acres, about four miles to the north west of the town; the Heaton gathering-ground, with an area of 523 acres, three miles to the west; and the Entwistle gathering-ground, with an area of 2137 acres, about six miles to the north. There are three sets of filters, designed and constructed under the supervision of the author in 1885, 1892, and 1901. The Sweetloves filters consist of four sand filter-beds, each 85 yards by 30 yards, or a total area of 10,200 square yards. They receive about 4 million gallons of water a day from the Entwistle reservoir, and about 1 million gallons from the Dingle reservoir. The filtered water is delivered into a clear-water tank of 2 million gallons capacity, where it passes by gravitation into the town mains. The rate of filtration is about 3 gallons per square foot per hour, or a percolation of about 6 inches per hour. The Markland Hill filter-beds receive the whole of the Heaton supply—an average of about 1 million gallons per day. The three sand filters deliver their contents to a clear water tank of 41,800 gallons capacity, whence the filtered water passes by gravitation both to the Heaton service reservoir and direct to the distributing-mains. The total area of the three beds is 3658 square yards. The rate of filtration is about 2¼ gallons per square foot per hour, or a percolation of 3·6 inches per hour. The two Dingle filters are each 40 yards by 20 yards (total area, 1600 square yards), and deliver into two clear-water tanks of 52,500 gallons capacity, and thence into the high-level main. The rate of filtration is about 1½ gallons per square foot, or a percolation of about 3 inches per hour. The following is a summary of the particulars of the various reservoirs :—

STORAGE RESERVOIRS.

Reservoir.	Area. Acres.	Capacity. Gallons.	Depth. Feet.	Height in Feet of Top Water Level above O.D.
Entwistle	94	625,000,000	100	690·35
Springs	24⅜	134,000,000	48	757·56
Dingle	15	79,000,000	30	717·41
High Rid	24½	130,000,000	32	578·50
Crowthorne	1¼	3,500,000	19	1023·00

SERVICE RESERVOIRS SUPPLIED FROM THE STORAGE RESERVOIRS.

Sweetloves	12⅜	90,000,000	30	517·00
Heaton	16½	91,000,000	28	517·00
Totals	188⅞	1,152,500,000		

COMPENSATION RESERVOIRS.

Belmont	97½	468,000,000	82	853·55
Rumworth	33¼	95,000,000	32	363·37
Wayoh	71¼	550,000,000	76	547·99

In a description of the Rivington watershed, which was visited on Wednesday, Mr. Joseph Parry, M.Inst.C.E., the Engineer of the Liverpool Corporation Water-Works, says—

The Rivington watershed comprises about 10,000 acres of thinly inhabited hill and moorland on the millstone grit formation, lying between Bolton and Blackburn. The principal streams on the watershed are the Roddlesworth, Rake, Yarrow, and Douglas; and the rainfall is collected into reservoirs formed by earth embankments carried across the natural valleys. There are altogether eight reservoirs; and they contain, when full, 4105 million gallons. Their total surface area at the overflow level is 598 acres; and their total length, measured along the top water lines, is 5½ miles. The total length of the embankments is over three miles. The highest bank is that of the Yarrow (Leicester Vale) reservoir, which is 103 feet above the bottom of the valley. The deepest puddle trench is also at the Yarrow reservoir (Turner's bank). Here the trench had to be carried down to a depth of 167 feet below the natural surface before a solid foundation could be obtained; the total height from the bottom of the foundation to the top of the dam being 257 feet. All the water has to pass into and through the lower reservoir. From this reservoir the water is drawn off for filtration through sand filters. The original filtration works consisted of six beds, having a total area at the surface of the sand of 182,982 square feet, and two open filtered-water tanks capable of holding 8,384,000 gallons. In 1870-5 two additional filter-beds were constructed. The area of these two is 71,302 square feet; making the total filtering area of the eight beds 254,284 square feet. The average rate of filtration during the year 1899 was 2,243,538 gallons per day per acre of sand surface, or 8¼ cubic feet per square foot per day.

It was not a large party who left Bolton at the early hour of 7.15 on Friday morning for a day's excursion, which for its length is unprecedented among the outings of this organization; for it was not until about midnight that those who braved the trip found themselves again in the town which they had quitted nearly seventeen hours before. Windermere and Thirlmere were the two features of the day. Arriving at Lake Side Station, Windermere, the visitors proceeded by boat to Bowness, where luncheon was taken at the Royal Hotel. Immediately after, brakes left for Thirlmere. In this huge completed scheme for the supply of Manchester's great and teeming population, the visiting engineers were immensely interested. On a handy little card (bearing the name of Sir John Harwood, the Chairman of the Manchester Corporation Water Committee) were printed the salient features of the scheme. Never before have these works been so succinctly and yet completely described so far as essential points go; and we cannot consequently do better than simply reproduce the particulars :—

The scheme was prepared by the late Mr. Bateman, F.R.S. (the Engineer of the Longdendale Works), in connection with Mr. G. H. Hill, who has carried it out on behalf of the Corporation; Mr. Bateman having died on June 10, 1889.

Levels of Lake above Sea Level.—Natural level of lake 533 ft. 2½ in. Level when raised 20 feet for the supply of the first instalment of 10 million gallons a day, 554 feet. Level when raised to full extent of 50 feet, 584 feet. Length of lake when raised 20 feet, 3 miles 500 yards. Length when raised 50 feet 3⅛ miles 220 yards.

Drainage Area to Lake.—Natural drainage area, 7400 acres. Additional drainage area to be hereafter diverted into lake, 3600 acres—11,000 acres.

Area and Capacity of Lake.—Natural area 330 acres. When raised 20 feet for the supply of the first instalment of 10 million gallons a day, 565 acres; capacity, 2534 million gallons. When raised to the full extent of 50 feet, 793 acres; capacity, 8135 million gallons.

Compensation Water.—Quantity of water discharged into St. John's Beck before diversion of additional drainage area into lake, 4,126,125 gallons per 24 hours. When lake is raised to the full extent of 50 feet, 5,520,487 gallons.

Embankment at Lake.—The level of the lake is raised by means of an embankment, constructed at the outlet into St. John's Beck. The top of the embankment is 6 ft. 3 in. above the level of the lake when fully raised. Length of embankment, 857 feet. Width at top of embankment, 18 ft. 6 in. Greatest height of embankment from foundation, 104 ft. 6 in.

Roads.—Length of new roads constructed by the Corporation, 8 miles 1130 yards.

Aqueduct.—Aqueduct constructed to convey 50 million gallons a day. Diameter of aqueduct, 7 feet. Fall of aqueduct, 20 inches per mile. Length from Thirlmere to Manchester, 95 miles 1642 yards—viz., tunnels, 14⅛ miles; cut-and-cover, 36¾ miles; pipes, 45 miles. Diameter of straining-well for the admission of water into the aqueduct from the lake, 37 ft. 6 in.; depth, 65 feet.

The rainfall over the watershed varies from 52 to 137 inches per annum. The storage, when all the works are completed, will provide 50 million gallons of water per day for 160 days, even if no rain falls during that time, without drawing below the original margin of the lake. It is intended to bring the supply by instalments of 10 million gallons a day, at such intervals of time as may be found necessary.

The purchase of the watershed, including the lake and the wayleave for the tunnels and cut-and-cover, and for the laying of five lines of syphon pipes across the valleys from Thirlmere to Manchester, and the works as carried out—*i.e.*, all the tunnels and cut-and-cover or concrete tunnel constructed near the surface of the ground to convey 50 million gallons per day, and one line of pipes to convey 10 million gallons per day to Manchester—has cost above £2,700,000. When the five lines of pipes have all been laid, and the lake raised 50 feet, it is estimated that the cost will be between four and five millions sterling. The first contract was let in 1885; and the works for the supply of the first instalment were completed and opened on Oct. 12, 1894.

The inspection naturally occupied a considerable time; and the evening was far advanced before the members reached Bowness again. Dinner was served at the Royal Hotel, and the return journey was afterwards entered upon. Midnight saw the completion of the full programme of arrangements that had been made for the week.

REGISTER OF PATENTS.

Manufacturing Gas Consisting Chiefly of Methane or Marsh Gas, for Illuminating, Heating, and Power Purposes.—Elworthy, H. S., of New Broad Street, and Williamson, E. H., of Fenchurch Street, E.C. No. 12,461; May 31, 1902.

It is well known, the patentees remark, that the ordinary coal gas of commerce owes its high calorific value to the presence of methane, which usually forms about 30 per cent. of the product; while natural gas, the high calorific value of which is so well known, frequently consists almost entirely of methane. By their process, they manufacture the gas from water gas by first forming a suitable mixture of carbon monoxide, carbon dioxide, and hydrogen, or a mixture of hydrogen with either one of the above oxides of carbon (adding hydrogen where necessary), and then pass such mixture of gases over finely divided nickel at a suitable temperature.

As methane consists of hydrogen and carbon in the proportions represented by the formula CH_4, it is necessary to have a sufficient quantity of hydrogen present in the water-gas mixture, not only to combine with the carbon to form the methane, but also to combine with the oxygen liberated from its combination with the carbon. Water gas made in the ordinary way consists, however, principally of a mixture of carbon monoxide and hydrogen in nearly equal volumes, together with a small quantity of nitrogen and carbon dioxide. For their purpose, it is necessary to have about three volumes of hydrogen to one volume of carbon monoxide in order to obtain the reaction represented by the equation $CO + 3H_2 = CH_4 + H_2O$. If, however, the water gas is so made as to consist largely of carbon dioxide and hydrogen, then it is necessary to have about four volumes of hydrogen to one volume of carbon dioxide, in accordance with the equation $CO_2 + 4H_2 = CH_4 + 2H_2O$. In the method of manufacturing water gas generally adopted, it is essential to raise the proportion of carbon monoxide to the highest limit obtainable, and to keep down the proportion of carbon dioxide to the lowest limit. For their purpose, however, this is more or less a matter of indifference, as they can utilize the one as well as the other. Therefore, while in the ordinary well known processes of water, gas manufacture (except in the case of the Dellwik-Fleischer process) the blowing-up method is generally at least twice as long as the steaming progress, in the present case the steaming period may be very considerably increased, and, consequently, a far greater quantity of water gas is obtained at each reversal—thereby effecting a saving of fuel now lost during the prolonged blowing-up periods.

Having obtained the water gas (conveniently this modified form of water gas), the patentees proceed to secure the necessary quantity of hydrogen to bring up the proportions to those stated above, according to the composition of the water-gas mixture. In order to do this, they obtain hydrogen by any of the well-known processes, as by the electrolysis of water, in which case the oxygen may be collected for commercial use. But they prefer to obtain it by the reaction of steam upon metallic iron, whereby, at a suitable temperature, the steam is decomposed, the hydrogen liberated, and the iron converted to the state of magnetic oxide, in accordance with the equation $3Fe + 4H_2O = Fe_3O_4 + 4H_2$. According to one part of the invention, they effect the production of the hydrogen by the action of steam on iron by storing up the heat produced in one part of the process—namely, the reduction to the metallic state of the magnetic oxide of iron produced during the hydrogen making stage—and thus render the heat available to assist in the carrying out of the reaction.

Having obtained a suitable mixture of carbon monoxide, carbon dioxide, and hydrogen, they proceed to pass the mixture over finely-divided nickel, whereby the carbon is hydrogenized; and the oxygen liberated is converted into water by the excess of hydrogen present. The nickel apparently takes no part in the reaction, as at the end of the operation it remains unaltered—the reaction belonging apparently to the so-called catalytic or contact order. The nickel may simply be placed in layers in the powdered state, upon suitably arranged shelves, in a retort-chamber, or other vessel, or it may be caused to adhere to the surface of some porous material, as broken fire-brick, pumice stone, or asbestos fibre, an agglutinating and not easily fusible substance being used, such as pipe-clay, fire-clay, magnesium chloride, or other suitable material, or the finely-divided nickel itself may be made up into balls or blocks of any suitable size, by being mixed with an agglutinating material, and preferably also with some organic material such as sawdust, which can easily be burned away, leaving the blocks more porous. The finely-divided nickel as produced by the Mond reaction is especially suitable for this process; and its employment therefore constitutes a feature of the invention. The nickel, however prepared, is placed in a retort, tower, or chamber, heated to the required temperature—say, for example, 250° C. for the carbon monoxide, and 350° C. for the carbon dioxide; and the gases may also be heated before admission to the chamber. As the temperature of the reaction with carbon monoxide is lower than that with carbon dioxide, the process may be conducted in two stages; the first part at the lower temperature to convert the carbon monoxide to methane, and the latter part at a higher temperature in order to convert the carbon dioxide to methane, and the gases may be reheated during the intermediate stage. The two stages are preferably conducted in separate chambers. The methane is collected in a holder for use.

After the removal of the carbon dioxide, the mixture of carbon monoxide and hydrogen is in the right proportion for the production of methane. Any of the following processes may be used for the removal of the carbon dioxide.

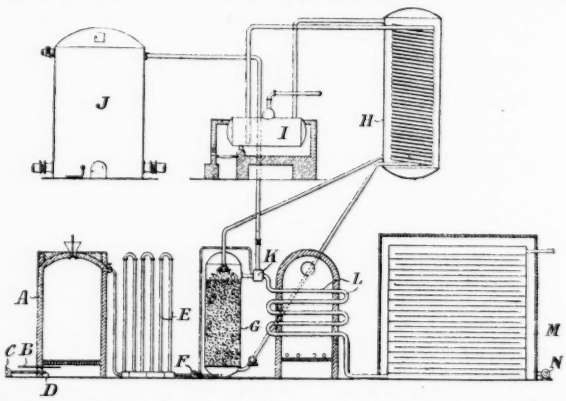
1.—It may be passed over slaked lime, whereby carbonate of lime is produced; and the lime may be revivified by any process such as Hislop's.

2.—The gases may be passed over an alkaline carbonate, or through a solution of these salts, and the carbonic acid may be recovered from the moist salts by passing superheated steam over them, or it may be recovered from the solution by boiling. In either case, the mono carbonate is regenerated, and the carbon dioxide recovered in a very pure condition, and suitable for commercial utilization when compressed to the liquid state or solidified, as may be done by the process described in patent No. 7436 of 1895.

3.—The carbon dioxide may be removed from the mixed gases by absorption in water. This may be done in the manner described in patent No. 7281 of 1895, which is a continuous process, or it may be removed by compressing the gas alternately into two vessels connected by means of a three-way valve; the vessels being fitted with agitating devices, and the compressed mixture of gases forced into one end of the vessel. The carbon dioxide is absorbed during its passage to the other end; and the insoluble hydrogen and carbon monoxide escape through a suitable valve at the opposite end, where they are collected and conveyed to a storage holder. When the pressure in the vessel reaches a set limit—such as five to ten atmospheres—the three-way valve is automatically reversed, and the compressed gases pass into the other vessel. At the same time, the outlet valve for the insoluble gases is closed, and an escape valve for the carbon dioxide opened. This is rapidly given off from the water as the pressure is lowered; while the liberation is facilitated by the agitation being continued. The carbon dioxide so liberated may be collected for use, and be further purified from the remaining traces of hydrogen and carbon monoxide by passing over copper oxide, as described in patent No. 25,007 of 1897.

In the accompanying illustration is shown an arrangement of apparatus for the practical application of the invention, taking as examples the methods described in which a water gas is produced consisting substantially of a mixture of monoxide and dioxide of carbon and hydrogen; the dioxide being either removed or not, any hydrogen being added if necessary to bring the proportion thereof up to that required to substantially transform the oxide or oxides of carbon into methane and water. The practical application of the invention in accordance with the other modifications described will then be readily understood.

A is the water-gas producer; B, the steam inlet; C the air-blower delivering the air blast thereto when required by the inlet D. E is a condenser through which the water gas passes on leaving the producer; a valve being interposed to regulate the flow of gas as required. F is a blower for drawing the gaseous mixture from the condenser and forcing it through the system; and to it is fitted a three-way cock, whereby the gaseous mixture may be directed to the carbon dioxide absorber G, or led direct to the pipe beyond the absorber, according as it is desired to remove the carbon dioxide from the gaseous mixture or not.



The carbon dioxide absorber is shown as of cylindrical form with domed ends. It is provided with a perforated false bottom or grid, upon which is supported a sufficient depth of broken fire-brick, coke breeze, or the like. When the three-way cock is turned to direct the gases to the absorber, they are delivered by the blower to the space below the false bottom, and rise up through the material thereon. There is a spraying head attached to the pipe, which serves to spray a solution of carbonate of potash upon the surface of the coke or other material in the absorber. The pipe leads from the casing of a heat interchanger H, containing a coil the upper end of which leads to a boiler I—the pipe dipping down to near the bottom of the boiler. Another pipe leads from the top of the casing of the heat interchanger to the top of the boiler. The bottom of the coil communicates with one chamber of the absorber G; a circulating pump being interposed between the coil and the absorber. The pump serves to draw the solution of bicarbonate of potash, resulting from the absorption of the carbonic acid by the carbonate of potash solution, from the bottom of the absorber and deliver it to the boiler, where the carbon dioxide is driven off by the heat of the furnace, and passes away from the crown of the boiler to a suitable gasholder or other apparatus for use as required. The regenerated carbonate of potash solution passes from the top of the boiler through the casing of the heat interchanger, where it heats up the cool solution in the coil (being itself cooled by the incoming bicarbonate of potash solution) and passes to the top of the absorber, where it is sprayed over the coke or fire-brick filling by the spraying head. In this way, a solution of carbonate of potash is continuously delivered to the absorber, where it meets the gaseous mixture and absorbs the carbon dioxide therefrom; the resulting solution of bicarbonate being passed through the heat interchanger to the boiler, so that the dioxide is usefully recovered and the heat is advantageously economized

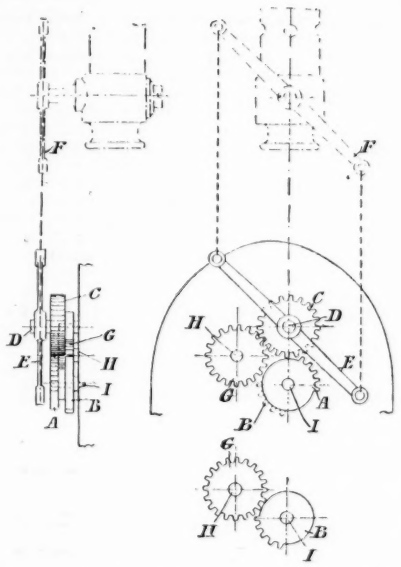
J is the hydrogen producer, from the upper part of which the hydrogen generated passes to the mixing-chamber K, so as to effect the proper admixture of the gases therein. A valve is interposed in the connecting pipe to permit the supply of hydrogen to be regulated so as to adjust the hydrogen in the ultimate mixture to the desired proportion, as before explained, or to allow of the hydrogen being shut off when it is not required to mix it with the gases passing to the nickel chamber or for other purpose as required.

The chamber K is connected to a coil or serpentine L, arranged to be heated by gaseous or solid fuel as desired, and provided with means

for regulating the temperature. In its passage through the coil or serpentine, the gaseous mixture is heated to the proper temperature to ensure the desired reaction between the mixture and the nickel in the nickel-chamber when it is delivered thereto. From L, the mixture passes to the nickel chamber M. This chamber is of rectangular form, and constructed with a hollow casing through which air may be circulated by a pump N when required, so as to control the temperature within the chamber or chambers. The nickel is carried on trays superposed in baffled order in the chamber in such manner that the gaseous mixture passes up in a serpentine course over each of the trays successively from bottom to top, and is brought into intimate contact with the nickel thereon. The methane produced in the chamber passes off from the top, whence it may be led to a gasholder; or, when a mixture of carbon monoxide, carbon dioxide, and hydrogen is employed in the reaction, the resulting mixture of methane, carbon dioxide, and hydrogen is preferably led through a second superheater and a second nickel chamber, similar to those just described, before passing to the gasholder.

Lighting and Extinguishing Gas-Lamps Automatically.—Westenholz, T. F., of the Strandvej Gas-Works, Hellerup, near Copenhagen. No. 17,238; Aug. 5, 1902.

The patentee's object is attained by connecting a clockwork with the gas-cock of the lamp, so that the latter is opened and shut by the former; thus setting in motion a cog-wheel, chain-pulley, or lever acting on the cock, as shown in the accompanying engraving—a side view of the mechanism for shifting the cock, a front view, and a detail of the shifting wheels.

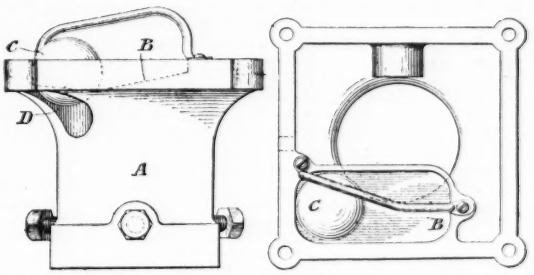


The opening and shutting of the cock takes place as follows: On the spring-box wheel of the mechanism is put a cog-wheel, geared with another cog-wheel behind and joined to which two other wheels A B are placed. The teeth on each of these wheels are removed from a part of the periphery; the tooth-sections left being diametrically opposite each other. The cog-wheel A is geared with another wheel C, fastened to the axle D. On this axle a double arm E is placed, conveying the movement by means of chains to a similar arm F on the burner cock. The mutilated cog-wheel B is geared with a cog-wheel G on the axle H. The wheel G meshes with the wheel C. The mutilated wheel A during each of its revolutions engages the wheel C, causing it to rotate partially. The mutilated wheel B, however, does not engage the wheel C, as may be seen. The wheel B engages the wheel G; and when the clockwork at a previously adjusted hour moves the axle I part of a revolution, the wheels A B are each also moved part of a revolution. Should there now be a part of the toothed edge of the wheel A in connection with the wheel C, this latter is moved a part of a revolution; and this movement is conveyed, by means of the arms and chains, to the cock, which is opened. By the next revolution of the axle I, wheels A B are again moved a partial revolution. But when this happens, the tooth edge of the latter wheel will be put in gear with the wheel G, while the wheel C is beyond the reach of the teeth of the wheel A. The movement of the wheel B turns the wheel G, and therefore the wheel C gets a movement in the opposite direction it formerly had, and the cock is thereby also moved in the opposite direction—that is to say, it is closed.

Lanterns for Public Gas-Lamps.—Sugg, W., of Westminster. No. 18,333; Aug. 20, 1902.

Since the introduction of incandescent gas lighting, the patentee points out that it has been found necessary to modify the parts of lamps used for public lighting "in a manner hitherto unexpected." The lantern has usually been secured to the post by frogs. But it has been found that the connection is not rigid enough for the purpose; and so plans have been proposed whereby the desired rigidity has, to a great extent, been secured. But such plans have not provided for the lighting of the lamp by a "tilting" torch of the kind which has recently come much into vogue.

The object of the present invention therefore is to provide a satisfactory solution to this problem; and the invention consists in so forming the bottom of the lantern, and securing it to the post, that the required rigidity will be obtained and the insertion of means for lighting amply allowed for. To effect this, a cylindrical socket to fit on to the top of the post is employed; and to the socket is attached (or there is formed with it) a solid bottom for the lantern, having a central hole for the gas-supply pipe. On one side of this bottom is formed a cradle for a ball valve, such as is described in patent No. 14,692 of 1900, or it may be lugs or other device, to receive a flap valve or other suitable contrivance to close an opening provided for the insertion of the torch. The lantern is bolted to the solid bottom, and thus ample rigidity is secured.

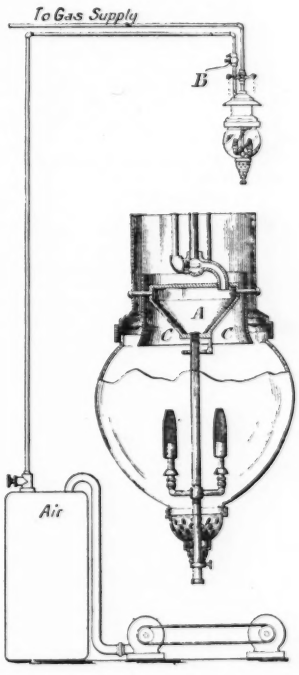


A is the cast metal socket which fits on to the stump of the lamp-column (not shown), to which it is secured by screws. The socket has a central opening for the gas-supply pipe. D is a solid lamp bottom, preferably cast with the socket as shown. To this bottom, the lamp ribs are secured in any convenient manner. B is the ball-valve cradle (of the construction before referred to); C the ball valve, and D the inlet for the torch.

Gas-Burning Lamps.—Hartel, A. E., of Philadelphia, Pa., U.S.A. No. 10,200; May 5, 1903.

This invention has for its object to provide a lamp in which gas and air under pressure can be mixed, heated, and burnt upon incandescent mantles; the products of combustion being utilized to heat the chamber in which the gas and air are mixed. A further object is to provide a preheating chamber into which gas is injected by air under greater pressure than the gas, and means for ensuring (at all times) an even pressure of air, and, consequently, an even pressure of the mixture. A still further object is to provide a lamp with a preheating chamber in which gas and air under pressure are heated by the otherwise waste products of combustion, and so to construct the lamp as to compel the products of combustion to envelope the preheating chamber.

The novel features of construction, combination, and arrangement of parts will be sufficiently appreciated from the accompanying engraving of a section of the lamp and a diagrammatic view of the complete apparatus.

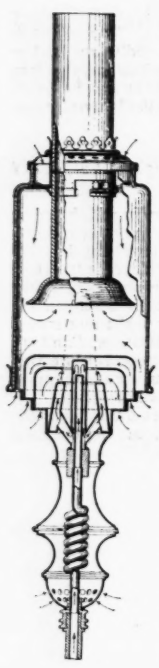


The gas passes down through the chamber A to the burners, and is ignited by a pilot light, preferably burning at all times, and which imparts a certain amount of heat to the chamber, and prevents its being thoroughly chilled. Air is then turned on; it being supplied at even pressure (due to the governor B), and in excess of the gas pressure. The discharge of the air into the injector chamber, and directly into the gas therein, serves to draw the gas with it into the preheating chamber A, where the gas and air are thoroughly mixed and highly heated, and passed with undiminished pressure to the burners. The hot products of combustion from the burners are directed up through the sleeve C, to compel the thorough enveloping of the chamber by the hot products, to heat it to a high degree and insure the thorough heating of the mixture.

Atmospheric Gas-Burners.—Ehmann, C. P., and Morton, F., of Manchester. No. 10,365; May 7, 1903.

In a gas-burner constructed according to this invention, the lower part of the burner for the admission of air and gas is made in the ordinary manner; but (as shown) the nozzle through which the mixture escapes has, in one form, a single elongated aperture or slot, or else two or more such apertures. The gas enters the mixing-chamber from below; while the air enters through lateral apertures. At the upper end of the mixing-chamber is the nozzle, the embouchure of which is formed as a slot, so as to make a wide flattened frame. The sides of the slot are splayed outwards to form a kind of V-shaped trough, with the point of the V cut away. Burners constructed in this way are particularly adapted for use in gassing frames, in which yarn is passed through a flame for the purpose of singeing it. The outwardly inclined sides of the embouchure direct the mixture of air and gas so as to thicken the flame at the part where the yarn passes through. To minimize or prevent lighting-back, to which such jets are liable, there may be inserted in the mixing-chamber a coil of wire such as described in patent No. 15,185 of 1901.

Gas-Burners.—Guimaraes, J., of Hamburg. No. 10,399; May 7, 1903.

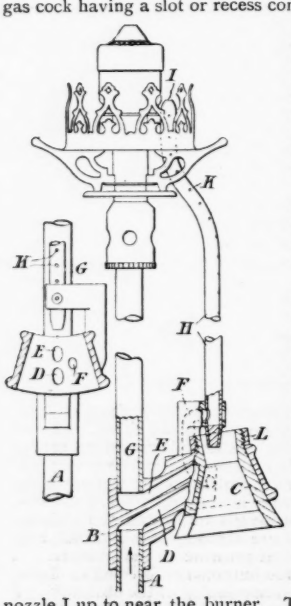


The accompanying illustration shows a burner according to this invention in longitudinal section. The pipe that supplies gas to the burners is surrounded by a shell or casing, into which air is admitted through perforations arranged at the bottom. To the feed-pipe is connected a coil pipe, which terminates in a pipe perforated at the top above the burner-ring. A cap-tube closed at the top is arranged over the top of this pipe, and supports a ring burner. The lower casing terminates in a cylindrical gallery increased to the required diameter by means of step-shaped enlargements provided with air inlet holes. On two of the steps are placed caps or inverted cups; while the top step supports a glass cylinder in which depends a chimney provided at the bottom with a bell-mouth, which helps to cause the flame to assume the shape of an "incandescent" flame.

The working of the device is as follows: Gas entering the feed-pipe passes through the coil into the upper pipe, strikes the under side of the top of the cap, and returns downwards outside the tube, and passes up two branch-pipes to the burner. The flame is caused to assume a round conical outer shape by the openings in the caps referred to; its blue portion being thus covered. For the purpose of effecting "complete combustion," air is not only admitted from below through the perforations, but also through orifices in the steps. The flame is compressed and condensed by the air entering between the step and the burner, as well as between these steps and the chimney. The air is "strongly heated, so that an intensely white flame is obtained without any mantle."

Igniting Gas-Lamps.—Muylwyk, P. B., of Gouda, Holland. No. 11,751; May 22, 1903.

The patentee proposes to provide the gas-pipe of the lamp with a gas cock having a slot or recess communicating on the one hand with the pipe leading to the lamp-burner, and on the other with an "ascending flame" igniter tube, extending from the gas-cock casing up to near the burner, and by means of which the flame of the lighting pole, used for turning the cock, is communicated to the burner, so as to ignite the lamp flame.



The igniting arrangement is illustrated partly in section (and in connection with a burner) and in longitudinal section, with the plug of the cock removed.

The gas-pipe A of the lamp does not lead direct to the burner, but is connected with a cock casing B, provided with three passages D, E, F, communicating with the bore for the cock plug C. The passage D is connected with the gas-pipe A; the passage E communicates with the pipe G, which is connected at one end to the cock casing, and at the other to the burner; and the passage F communicates with an "ascending flame" igniter-tube H, carried by the cock casing. This igniter-tube H is preferably arranged so that its lower end is placed close above the cock C, and extends with its upper end, terminating in a small nozzle I up to near the burner. The cock plug is provided with an axial bore, and has an external recess by means of which the passage D can be made to communicate, on the one hand, with the passage E, and, on the other hand, with the passage F. At one of its ends, the cock plug is provided with one or several slots or notches, into which suitably formed catches or projections of the lighting pole, used for turning the cock, can be inserted. The extent of its revolution can be limited by a screw bearing against the casing.

The manipulation of the device is as follows: The lighting pole—provided with a lighting flame at its upper end, and fitted with a catch or projection fitting into the slot on the cock plug—is introduced into the axial bore of the cock plug C. By turning the plug to the right, the recess is placed over the three passage orifices D, E, F. Consequently, gas will flow from the pipe A into the pipe G leading to the burner, as well as into the igniter-tube H. Some of the gas entering the igniter-tube issues from the holes K arranged in it, and ignites on the flame of the lighting pole, which issues through the upper aperture of the bore in the cock plug. The flame thus ignited on the outer surface of the igniter-tube ascends along the series of holes K, and ignites the gas issuing from the nozzle I; and this flame will then ignite the burner flame. The ignition of the burner ensues immediately, and by continuing to turn the plug in the same direction, the orifice of the passage F is closed, leaving the passages D and E only connected with the recess, and cutting off the gas supply to the igniter-tube. Any further turning of the plug is prevented by the screw bearing against the cock casing. To extinguish the burner flame, the cock plug is turned in the opposite direction.

Fluid Meters.—Scotti, K., of Frankfort-on-Maine. No. 11,208; May 16, 1903.

The patentee claims the construction of 1. A liquid meter in which the movement of one or more bodies is transmitted by electrical or mechanical means to an indicating mechanism without any axial bearing or support being necessary for these bodies. 2. An electrical contact device for liquid meters in which the body moved by the liquid forces an easily movable object to produce a temporary closing of the circuit. 3. An electrical contact device for liquid meters in which quicksilver masses are so arranged, by means of their great cohesion, that a contact-giving body can freely be moved through the quicksilver masses. 4. In a liquid meter, means for protection against frost, in which the parts of the casing are elastically connected. 5. In electric liquid meters, means for switching on and switching off and operating the indicator for forward and backward travel; these means being operated by the loss of pressure resulting in the meter.

APPLICATIONS FOR LETTERS PATENT.

15,496.—Gardner, E., T. H., & L., "Internal combustion engines." July 13.

15,516.—Bloxam, A. G., "Incandescent gas or vapour burners." A communication from the Washington Licht Gesellschaft m. b. H. July 13.

15,551.—Kramer, W., "Gas-burners." July 14.

15,611.—Sheppard, W. D., "Gas cooking stoves." July 14.

15,630.—Bray, J. W., "Atmospheric burner for incandescent gas lighting." July 15.

15,645.—Kent, W., "Making gas." July 15.

15,651.—Dempster, R., and Sons, Ltd., and Broadhead, J. W., "Regenerator furnaces." July 15.

15,673.—Adams, A., "Extracting or obtaining gas for lighting, heating, driving engines, and other purposes." July 15.

15,729.—Bray, G. & J. W., "Adjusting the gas supply to incandescent and other atmospheric burners." July 16.

15,794.—Izzett, J., "Regenerative gas-furnaces for melting steel." July 17.

15,796.—Davies, C., and Lawless, C. G., "Clockwork or rotary register to be used with gas-meters." July 17.

15,797.—Bennis, E., "Manufacture of gas." July 17.

15,803.—Pearson, H. A., and Mitchell, A., "Incandescent lamps or burners." July 17.

15,952.—Tolson, J., "Incandescent lighting apparatus." July 18.

Goole Gas and Water Supply.—The report and accounts of the Goole Gas and Water Works for the year ending March 31, which were submitted at a special meeting of the Urban District Council yesterday week, showed that the revenue from the gas undertaking was £11,450, or £248 less than in the previous year. During the year incandescent burners were adopted for the public lamps, which affected the income to the extent of £245. The total expenditure was £6243, or £721 less. The gross income transferred to profit and loss account amounted to £5206. The revenue on water account was £3242, and the expenditure £950. The gross income transferred to the profit and loss account was thus £2291. The receipts were more than sufficient to meet the interest and principal payments.

Selby Water Supply Failing.—Owing to the serious state of affairs existing with regard to the Selby water supply, Mr. Percy Griffith has been called in to report; and he states that the Urban District Council are practically dependent upon a single engine, pump, and boring, which involves pumping 17 out of every 24 hours. The second engine is disabled; and both the boilers are very old. Of the two boreholes, one is of no use, while the water-level in the other has been steadily falling of recent years. In addition to this, the existing storage only represents a supply to the town for 18½ hours at the average rate of demand. Under these circumstances, Mr. Griffith strongly urges that immediate steps be taken to secure an alternative source of supply, and to provide new and independent machinery for delivering it into the mains. At a special meeting of the Council last Wednesday, it was agreed that, providing arrangements could be made with the Earl of Londesborough as to a site, a trial boring should be sunk at Brayton Banff, as advised by Mr. Griffith, and that the Local Government Board should be asked to sanction a loan of £1200 for the purpose.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Crystal Palace District Gas Bill.

SIR,—I think Mr. Carr's letter in this week's "JOURNAL" needs an answer.

The question of "that most careful and amiable of leaders of the Parliamentary Bar," as you described him, whether the consumer would "lose practically 1s. per 1000 by the reduction of 2 candles, I regarded as one of the "false issues" which a high authority says Counsel are paid to raise, and I told him it was absolute nonsense.

Now, however, that Mr. Carr—a responsible engineering witness—repeats a definite statement to that effect, I will endeavour to treat it more seriously by testing the reliability of the witness. In 1900, in opposition to the South Metropolitan Bill for reducing from 16 to 14 candles, Mr. Carr made a similar statement, in which he put the loss to the consumers at 9d. per 1000 feet. This has been proved in Mr. Carr's hearing to have been a mistake; the consumers of that Company burning not any more 14-candle gas than they did of 16 candles, and I may add that complaints have been fewer. Actual practice thus completely contradicted Mr. Carr's theory. It, however, produced no effect upon him; for in his evidence on the Crystal Palace District Gas Bill, he put the loss to the consumer for a reduction of 2 candles at 10d. per 1000 cubic feet, and he further increased it to 1s. in his letter in the "JOURNAL," which should have been 1s. 7d. had Mr. Carr been able to make a simple calculation correctly, as I will show.

He says the South Metropolitan special 14-candle flat-flame burner gives with 15-candle gas "an efficiency duty of 2·5 candles per cubic foot," and "with the 13-candle gas the Company propose to supply, the efficiency is but 1·5 candles per cubic foot, or a difference of 40 per cent." He then says that the consumer, "to obtain the same light with the proposed gas as he does with the present, must burn 40 per cent. more; or, in other words, he must burn 1400 feet in place of 1000 with the 15-candle gas."

If the reduction of 2 candles reduces the light from 2·5 to 1·5 candles per foot, then not 40 per cent., or 1400 feet, but 66⅔ per cent., or 1666 feet, must be used to give the same light. The result in money is as follows—the price of the 15-candle gas being 2s. 7d. per 1000, and the 13-candle gas 1d. lower—

1000 feet 15-candle gas, at 2·5 candles per foot, gives 2500 candles for 2s. 7d.
1666 ,, 13 ,, ,, 1·5 ,, ,, ,, 2500 ,, ,, 4s. 2d.

A difference of 1s. 7d. if the witness had made a reliable calculation. But what absolute nonsense it is!

Further, he carried out his experiments with the wrong burner; for the special burner for 13-candle gas has not been made. Dr. Clowes two or three months ago applied to Mr. Sugg for the 13-candle burner we proposed to supply, and got the answer that, as no instructions had been received as to a special 13-candle burner, it could not be supplied. Therefore, the wrong burner was used for the experiments, and I should say also the wrong gas; for whether their 13-candle gas was produced by Dr. Clowes's plan of what he calls "stripping"—that is, I believe, passing it through a heavy oil—or whether Mr. Carr reduced his quality by driving his exhauster faster, and thus drawing in furnace gases for the three hours' make of low-quality gas for his experiments, as stated in his evidence, I do not know. But it is greatly to be doubted that the experiments were made with genuine 13-candle gas, such as we should supply.

I must give one more proof of Mr. Carr's unreliability as a witness. On the question of sulphur purification, in his evidence against the Crystal Palace District Gas Bill, Lord Robert Cecil on May 7 said:

(916). I asked you whether you could reduce the 35 grains which are naturally in the gas to 20, without the use of lime?—In my own case, yes.

(917). You can in your own case?—Most decidedly.

(918). In what way?—By keeping a large body of oxide in use that is highly charged with free sulphur.

(919). Do you use lime at all?—Not at all.

(928). Then you reduce it from something under 35·30 to 20 by the free sulphur in the oxide?—We do.

(929). Who tests your gas?—We test it ourselves.

This was such an astounding statement that others besides ourselves determined to put it to the test; for the idea that the free sulphur in nearly spent oxide would do the work was found to be erroneous more than thirty years ago. I have the report of the Engineer of an important Company (on whose word everyone who knows him places complete reliance) of twenty tests of Widnes gas, made between May 29 and June 20, which give an average of sulphur compounds of 37·79 grains per 100 feet—the lowest test being 30·66 grains, and the highest 53·66 grains. Then Dr. Rideal made seven tests from June 3 to June 9, with an average of 34·54 grains; the lowest being 27·89 grains, and the highest 37·96 grains. And Mr. English, of the Crystal Palace District Gas Company (now going to New Zealand), made independent tests from June 3 to June 9; his average being 34·31 grains—the lowest 28, and the highest 38·39.

The consumers of Widnes, however, are not a penny the worse; but what becomes of Mr. Carr's reliability as a witness?

Reigate, July 24, 1903. GEORGE LIVESEY.

Evidence of the extended use of carburetted water gas in the United States is afforded by the fact that the United Gas Improvement Company, of Philadelphia, have under contract 51 sets of "Standard" double-superheater Lowe plant, having in the aggregate a daily capacity of about 55 million cubic feet. As the estimated annual sales of artificial gas in the United States are about 84,000 million cubic feet, or an average of 233 millions per day, the installations referred to represent nearly one-fourth of the yearly outfit.

PARLIAMENTARY INTELLIGENCE.

FROM THE COMMITTEE ROOMS.

North Western Electricity and Power Gas Bill. BEYOND the proceedings in regard to this one Bill, there is little to report in connection with the progress of private measures in Parliament last week; and even on this Bill and the colossal scheme it envelopes, there is little to be said. But that little is good, and will be hailed with much satisfaction by the gas industry in the northern part of the country. The Bill was submitted to the Commons Committee, of which Sir A. F. Godson is Chairman; and both promoters and opposition were represented before them by a strong legal force. In numbers, the opposition was not so great as when the Bill was in the Lords; but its quality was not by this in the least impaired. Sir A. F. Godson over this Bill has proved himself as sturdy in his judgment as he is in appearance; and he refused to allow that judgment to be dominated in any way by precedent. On the first intimation that the promoters expected that he and his colleagues would be guided by prior happenings, he administered a sharp rebuke, and told them plainly that the case would be decided solely on its merits. The strongest point of the opposition has undoubtedly been their protest against the conferring of a dual monopoly over such an extensive area of the country as was suggested, and with capital powers that it was patent to everybody, except the promoters themselves, were absurdly inadequate for giving effect to the powers and rights asked for. The cross-examination was pressed strongly against this feature of the scheme; and, even before the third witness for the Bill had completed his evidence, the Chairman gave expression to the conviction of the Committee that the capital was insufficient to justify the Bill, and that it would be well for the promoters to give up Cheshire and concentrate their attentions on the remainder of the area incorporated in the scheme. Counsel for the promoters were much perturbed over this announcement, and appealed to the Committee to be guided by the opinions of their experts. But the Chairman reminded them that Committees were not always guided by expert opinions; and he might have added that the variety of expert opinions on any and every subject brought before them was often more confusing than helpful. Another fight was made after an adjournment to retain Cheshire for electricity purposes, even if the Committee were against the promoters in respect of Mond gas; but they were inflexible, and, without hearing the opposition, who had a big array of witnesses present, pronounced that the preamble was not proved so far as Cheshire was concerned, but was proved with regard to the other portions. The Bill is to come before the Committee again to-day.

Bradford Corporation Bill. This Bill was considered by the Police and Sanitary Committee of the Commons last Tuesday. The small proposals connected with the water undertaking were discussed shortly, but were not opposed. They are only little supplementary works connected with the water aqueduct; and estimated to cost in all about £2600. For this, the Corporation wanted borrowing powers in addition to those granted last year. The gas section of the Bill was not questioned; and, subject to an amendment dealt with in the succeeding paragraph, it will pass forward without further discussion.

The Repayment of Parliamentary Costs. It is too hard to have to give credence to the remarkable statement made on behalf of the Bradford Corporation in the course of the proceedings on their Bill, that they did not understand a very simple intention as to the repayment of costs incurred in connection with their parliamentary promotions of the last few sessions. It appears that there is now owing in respect of Bills and Acts promoted by the Corporation £28,500, covering the years from 1897. Money has not been borrowed to defray the expenses of these Acts; a certain sum being charged to revenue each year instead. Some £4000 or £5000 has now been paid off. The period prescribed in the Corporation Acts for the paying off of the expenses connected with them is five years from the time the money for the purpose is borrowed. Instead of borrowing the money in the open market, the Corporation have raised it by overdraft—lumping the expenses of all the Acts together, and contributing every year to the liquidation of the sum thus formed. There is no regular amount set apart year by year for the purpose. From this it seems that the Corporation have not looked upon the provision of the Act of Parliament as an obligation to set apart one-fifth of the cost of the Acts each year. Moreover, the overdrafts referred to have been put in the annual accounts, but not in such a way as to show that they were obtained to meet the costs of the Acts. The result of this is that the Committee last week agreed not to give the Corporation power to borrow the costs of their present Act; the Committee being of opinion that, as they have not exercised their borrowing powers in this respect in connection with their previous five Acts, it would be idle to give them powers on this occasion. The Committee further resolved to make a special report as to the action which had not been taken by the Corporation; and they are going to ensure that repayments are in future made in the periods fixed and not be postponed indefinitely. In other words, the will of Parliament is to be superior to the will of the Corporation. Clause 54 of the Bill is therefore to be altered so as to make it perfectly plain, even to the Corporation of Bradford, that the repayment is to commence from the time the money is advanced, whether it be by banker or anyone else.

Ebbw Vale Water. The Bill by which the Ebbw Vale District Council are seeking authority to construct, among other things, additional water-works was the subject of inquiry by a Lords Committee last Wednesday. An explanation was given by Mr. G. F. Deacon as to the nature of the proposed new works. They comprise the raising of the sill of the existing reservoir, together with the acquisition of the Blaen-y-cwm reservoir and the raising of the

bank, which improvements, it was estimated, would result in an available daily supply of 1,350,000 gallons of water. Of this amount, 200,000 gallons will be given to the River Ebbw and the steel and iron works. But it was in regard to the Blaen-y-cwm reservoir that opposition was offered; and the point at issue was entirely as to compensation water being given to the River Clydach. It was contended by Mr. Deacon, Mr. Middleton, and others that the provisions of the Bill would not injuriously affect the Clydach. The Committee, however, were of a contrary opinion, and decided that compensation water must be given; the amount to be left to arbitration.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read the third time and passed: Newcastle-upon-Tyne Electric Supply Bill.

Bills Royal Assented: British Gas Light Company (Norwich) Bill, Broadstairs Gas Bill, Broughty Ferry Gas Provisional Order Bill, Hampton Court Gas Bill, Hexham Gas Bill, Hyde Corporation Bill, Ipswich Gas Bill, Leigh Corporation Bill, Merthyr Tydfil Urban District Council Bill, Nantwich Urban District Council Bill, Nelson Corporation Bill, New Hunstanton Improvement Bill, Scunthorpe Urban District Water Bill, Torquay Corporation Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bill reported: Bournemouth Gas and Water Bill.

Lords Bills read the third time and passed: Derby Gas Bill, Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

HOUSE OF COMMONS COMMITTEE.

July 21 to 23.

(*Before Sir* A. F. GODSON, *Chairman, Mr.* W. JONES, *Mr.* NICHOLSON, *and Mr.* SKEWES-COX.)

NORTH-WESTERN ELECTRICITY AND POWER GAS BILL.

The consideration of this Bill, which had come down from the House of Lords,* was commenced by the above-named Committee last Tuesday.

Mr. BALFOUR BROWNE, K.C., the Hon. J. D. FITZGERALD, K.C., Mr. ROGER WALLACE, K.C., Mr. GREIG, and Mr. EDWARDS represented the promoters. The appearances for the opponents included Mr. HONORATUS LLOYD and Mr. RHODES for Stockport; Sir RALPH LITTLER, K.C., Mr. LLOYD, and Mr. BANKES for Birkenhead; Mr. WEDDERBURN, K.C., and Mr. HUTCHINSON for the Stalybridge and Dukinfield Tramways and Electricity Board; Mr. LLOYD for Crewe; Mr. RHODES for Manchester; Mr. HOLMAN GREGORY for Hanley; and Mr. COURTHOPE MUNRO for the Stalybridge and adjoining District Councils.

Mr. BALFOUR BROWNE, in opening the case, said the North-Western Electricity and Power Gas Company sought authority to supply electricity and Mond gas over an area of 2000 square miles, including the whole of Cheshire and parts of Staffordshire, Derbyshire, Flintshire, and Denbighshire. The idea originated with a well-known engineer who had been connected with most of the Power Bills passed by Parliament, and who had had great experience of Mond gas. This gentleman had transferred the matter to a Syndicate consisting mainly of local manufacturers, who desired to use the power for the purposes of their business. The area, which had a population of 1½ millions, contained no less than 93 local authorities, but only 15 of them had any works of a like nature to those proposed. Some had power to supply electricity for lighting; but he maintained that it was not within the real function of a corporation to supply it for power. The Bill was on exactly the same lines as the Somerset Electric Power Bill, which the Committee had just passed, and the Yorkshire Power Bill. They were asked to strike out Crewe and other towns, just as they were asked to exclude Bristol from the Somerset Bill; but he thought the Committee would not go back upon the precedent they had made.

The CHAIRMAN remarked that every case must be decided on its merits.

Mr. BALFOUR BROWNE (continuing) said the promoters were asking to be allowed to supply to authorized distributors, to furnish current to railways and canals, and also to persons requiring electricity for power. In one respect the Bill was unique—it combined power to supply electricity with one to sell Mond gas. A Bill for the supply of such gas was passed two years ago; and it was a most convenient means of furnishing power. Counsel described the difference between producer gas and ordinary gas, and remarked that the former was very cheap indeed, one reason for this being that in its manufacture a most valuable material was produced. The electricity would be generated by the aid of their Mond gas; and the result would be that the current would be produced much more economically than usual. The promoters felt that, being in a position to get power so cheaply, they would be better able to compete with their rivals abroad. Mond gas would cost the consumer 8d. per 1000 cubic feet—the price was really 2d., but he would have to burn four times as much as ordinary gas, and so he said 8d. in order to compare it with the average figure of 2s. 9d. The cost of generating the electricity under the circumstances would work out at 0·353d. per Board of Trade unit, which could only be attained by the use of cheap gas. They proposed to construct four generating stations—two in Cheshire, one in Denbighshire, and one in Staffordshire. Counsel went on to deal with the opposition, which he said had dwindled considerably since the Bill had succeeded in the first House. The manufacturers were entitled to say they had a right to supply themselves with power; and no man could prevent anyone doing it if he chose. The policy of the various Corporations in trying to keep the Company from supplying their towns was suicidal; and he asked the Committee if they were going to say that the people of Crewe, for instance, should pay more for their electricity than if the Company were furnishing it. He suggested that the Committee should not go into the case at great length, after the decision given in the Somerset case, and the long and expensive fight in the other House. The promoters had made a mistake in exempting Chester from the operations of the Bill; and if he had been consulted, he should have said "No." But it was the only mistake of the kind they had made. Of the 93 local authorities, 46 were supporting them by resolution, and only 9 were opposing—the rest did not take any part at all.

Mr. *H. A. Humphrey* was then called in support of the Bill. He said that cheapness and utility practically summed up the whole thing. Mond gas led to a saving in many ways. Industries could be carried on in a cleaner manner, with less smoke, less fuel, labour, time, repairs, better results, and saving in space. He considered that the capital for the whole undertaking—£1,500,000—was quite enough to commence with. It would enable them to provide the entire district with electrical energy, and to supply upwards of 2000 million cubic feet of Mond gas per annum. As to the distance they would be able to send the gas, they could supply it in a straight line of 30 miles from each station. If the supply was in the form of the spokes of a wheel, they would be able to send the gas through five pipes of 6 miles each, or six pipes of 5 miles each, and so on.

Mr. WEDDERBURN cross-examined the witness very severely on his evidence. "How much," he asked, "would it cost to supply the whole of the area of 2000 miles with producer gas?"

Witness: It is too difficult to answer that question.

Do you mean to say you can give the Committee no estimate?—Witness replied that he could only do so in this way. If he took it that there were (say) 6000 factories and workshops in the area, and that perhaps 1200 of them would be customers, he could arrive at an estimate. But it might take two or three times as much to cover the whole area. He hoped that it would, for the Company would be glad to cater for a rapidly increasing demand.

It would cost £4,000,000 if you reach every possible customer both for gas and electricity?—Yes; perhaps it would.

The bulk of the remaining cross-examination was directed to showing that the Company's proposed capital was insufficient.

Mr. *H. E. Jones* said it could not be expected that ordinary gas would become a competitor with Mond gas for power purposes, as the statutory restrictions with regard to the purification of it rendered the price prohibitive.

Mr. *S. Z. de Ferranti*, an electrical expert connected with the Midland Power Company, was also closely questioned on the financial aspect of the scheme.

The CHAIRMAN (interposing) expressed a doubt as to whether the capital was sufficient to justify the Bill. He thought it might perhaps be well for the promoters to leave Cheshire alone altogether, and centre their capital upon the remaining portions of the scheme.

Mr. WALLACE said, after this expression of opinion, it would be best for the Committee to adjourn and so give him an opportunity of considering the matter.

The CHAIRMAN suggested that the promoters might be able to strengthen their position—a good financial man might possibly pull them through.

Mr. WEDDERBURN remarked that there was no provision for additional capital in the Bill, and no financial witness could pull them through.

Mr. WALLACE reminded the Committee that Mr. Ferranti, who was a man of great experience in these matters, had told them that the capital was sufficient to cover the area, and that he would not put more down in the first instance.

The CHAIRMAN: We believe that is his sincere opinion; but we are not always guided by opinions.

Mr. WEDDERBURN suggested that the best way out of the difficulty would be for the whole capital and hopes of the Company to be centred upon Staffordshire.

Mr. WALLACE remarked that if they were to go for the whole capital for the entire area at once, and it was not required, the Company would be put into a very awkward position. It was the wisest policy to commence with a small capital, and increase it if necessary.

Eventually the Committee decided to adjourn, in order to give the promoters time for consideration.

On the resumption of the inquiry on Thursday morning,

Mr. WALLACE said he had four propositions to put which were very inconsistent, and he asked the Committee to adjourn for a short time.

The CHAIRMAN said the Committee could not do this, as they had suggested all they could to simplify matters.

Mr. WALLACE said his first proposition was that Staffordshire, Flintshire, and Denbighshire should be retained. This left Derbyshire and Cheshire. The great difficulty of the promoters was that two of the generating stations were in Cheshire. They therefore proposed that these two counties should be left out of the Bill as regarded Mond gas, but should be given to the Company for electricity supply only.

The CHAIRMAN said the Committee would not be inclined to leave Cheshire in for one purpose if they left it out for another. They would say all or none for Cheshire.

Mr. WALLACE pointed out that their difficulty was that they had their generating stations there.

The CHAIRMAN said he had anticipated that this would arise, and that was why he asked a witness whether it would be possible to put one of the stations in Derbyshire.

Mr. WALLACE said they could not do it.

The CHAIRMAN: Then why did the witness say you could?

Some discussion followed, in the course of which it was stated that the promoters could get land for the purpose by agreement; but

* See "JOURNAL," Vol. LXXXII., p. 459.

Counsel retorted that though they might do so, they could not use it without statutory power.

The CHAIRMAN said the view of the Committee was that Cheshire must be left out for all purposes, and they could not allow the promoters to have a generating station in Cheshire. They would help Mr. Wallace by giving him clauses which would assist the Company as to their policy in Derbyshire. They found the preamble of the Bill not proved so far as Cheshire was concerned, but that it was proved with regard to the other portions. Any further suggestions as to the finance of the scheme could be brought forward on Tuesday.

Sir R. LITTLER said it was obvious that this could not be regarded as a precedent for granting a dual power of this kind to one Company.

The CHAIRMAN replied that every case must be decided on its merits, and that, for his part, he thought he had done with precedents altogether.

The Committee then adjourned till to-day (Tuesday).

ALDERSHOT GAS AND WATER ORDER.

The Board of Trade have issued a report setting forth their reasons or dispensing with the consent of the Farnborough Urban District Council to the application of the Aldershot Gas and Water Company for the above-named Order. The Company applied for power to raise additional capital, and to extend their existing gas-works in the parishes of Aldershot and Farnborough. They obtained the consent of the Aldershot District Council, but were unable to get that of the Farnborough Council; and they asked the Board to dispense with the consent of the latter authority. The Board held an inquiry at their office, and invited the attendance of representatives of the Farnborough Council and other local authorities, and also of various objectors to the Order; but no representative of the Council attended. They had not lodged any objection with the Board in regard to the application, and it appeared that they had passed a resolution to remain neutral in the matter. In these circumstances, it did not appear to the Board that there was any ground for refusing to grant the promoters the statutory powers asked for as regarded the parish of Farnborough; and, after hearing the representations made to them as to the various objections, they granted the Provisional Order, subject to certain modifications and amendments.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

July 23 and 24.

(*Before the* MASTER OF THE ROLLS, *and Lords Justices* MATHEW *and* COZENS-HARDY.)

Gale v. Rhymney and Aber Valleys Gas and Water Company.

This was an appeal by the defendants from the verdict and judgment entered on the trial of the action, which took place before Mr. Justice Phillimore and a Common Jury at Glamorgan. It raised the point whether a person who is entitled to demand a supply of water can, in the event of it being refused, bring an action for an injunction and damages, or whether he is bound to sue for penalties. The plaintiffs are builders carrying on business at Bargoed, in the county of Glamorgan. In 1900, it being necessary that six houses they were erecting should be supplied with gas and water, they instructed the defendants to provide and lay on all the needful service-pipes, which was done by workmen in the defendants' employ at the cost of the plaintiffs. About April, 1901, the plaintiffs instructed the defendants to provide and lay the necessary communication-pipes, in order to connect the services with the main; and this was done upon the understanding, as plaintiffs alleged, that there should be one communication-pipe for each pair of houses. The Company's Act provides that the undertakers shall not be bound to supply water unless each house has a separate service-pipe; and there was some dispute as to whether or not a man named Knight, one of the defendants' foremen, had given permission to connect one pipe to each pair of houses. Defendants denied that Knight had any authority to give such permission. After the pipes had been put down, the plaintiffs requested the defendants to connect them with the main; but they declined to do so unless a separate communication-pipe was laid to each house. After giving the usual notices, the plaintiffs connected the pipes with the main; but the defendants severed the connections, and the houses were consequently without a water supply. At the trial, the learned Judge granted an injunction restraining the defendants from preventing the plaintiffs restoring the connections; and the Jury assessed damages at £67.

Mr. S. T. EVANS, K.C., M.P., and Mr. SANKEY appeared for the appellants; Mr. ABEL THOMAS, K.C., and Mr. PARSONS represented the respondents.

Mr. EVANS argued at some length that the right of the plaintiffs was either to take a supply of water under section 53 of the Water-Works Clauses Act, 1847, or to have penalties under section 43 because they had not been supplied; and he submitted that there was no power in the Court to grant an injunction or to make a declaration.

Mr. ABEL THOMAS said the argument adduced on behalf of the appellants depended on one thing—viz., that there was a specific remedy in respect of the acts complained of given by the statute; but if there was no remedy given by the Act, then the argument which had been addressed to the Court did not apply. The statute entitled the plaintiffs to connect the service-pipes to the main, but it did not give them the right to go before the Justices to recover penalties in respect of the severance of the connection. The plaintiffs could not sue for penalties if the service-pipe was not connected with the main owing to the act of the Company; and the injunction was granted with the very object of preventing the Company severing the connection.

Mr. EVANS having replied upon the whole case,

The MASTER OF THE ROLLS delivered judgment. He said this was an application for judgment in a case tried before Mr. Justice Phillimore and a Jury, and the action arose between the owner of certain houses and a Water Company. The Company had cut off the connection which had been properly made by the owner, under the provisions of an Act of Parliament, with the main of the Company, who claimed that they were entitled to sever the connection. The action having been brought by the owner against the Company, a defence was set up that the latter were entitled to sever the connection because there was a provision made by themselves—not a statutory provision—for the better working of their undertaking, that service-pipes should be laid only under certain conditions between the houses and the mains; one of the conditions being that each house should have a separate and exclusive connection between it and the main. Here the Company's representative had assented to a row of houses which the plaintiffs were erecting being supplied by one service-pipe to each pair of houses; and the pipes were laid down under the supervision, and with the assent, of the representative. The Company now said that what had been done was beyond his authority—he having no power from them to sanction any such arrangement. This was the point on which the action went down for trial; and the Jury found that the representative had, as a matter of fact, sanctioned the mode of connection which had been made, and also that he had power to authorize such connection. Whether he actually had authority or whether he was held out by the Company as having it, did not in the least matter; as it was proved that the connections between the houses and the main were properly made under the provisions of the Act of Parliament. Now, the rights of the parties were regulated by sections 48 and 49 of the Water-Works Clauses Act, 1847, which was incorporated with the Company's Special Act. Section 48 provided for the owner laying pipes so as to communicate with the main; and section 49 provided that, in case of dispute as to the manner in which the pipe should be made to communicate, it should be settled by two Justices. No such question arose here; and the owner actually did connect his service-pipe with the main of the Company. In this state of things, the Company, disputing the right of the owner to have one service-pipe for each pair of houses, took the matter into their own hands, and cut off the connection. It was impossible for them to say that there had not been a breach of their obligation, as there was no statutory power which enabled them to disconnect the pipe. This was very important—in fact, crucial—because the answer to the case was not that the Company did not do a wrong, but that the particular remedy for the wrong was to be found in special provisions of the Act. In support of this contention, reference was made to section 43, and to the case of *Atkinson v. Newcastle Water-Works Company*. The section named was directed to keeping sufficient pressure in the mains; and it dealt with the obligation to supply individual occupiers. Mr. Evans, in effect, said the action was by the owner against the Water Company for refusing to furnish him with water; and as the Act prescribed certain penalties for such an offence, the only remedy was under that section, which was not what the plaintiffs were suing for. But that depended entirely upon whether the cause of action was or was not one for which penalties were prescribed; and it was not necessary to pronounce an opinion upon this part of the case, unless it was clearly shown that the action was brought for something for which a penalty was prescribed. Here there was no provision in the General Act or the Company's Act which imposed a penalty for cutting off the water. The Company had misconceived their position, and had committed a trespass upon the plaintiffs' property by cutting off the supply; so that there was clearly a cause of action at common law for the wrong done. The only answer made was this: The object for which you connected your pipe with the main was that you might have a supply of water. We have wrongfully cut off the supply, and what you are suing us for is for not supplying you with water; and for this the remedy is penalties. But what the plaintiffs were suing for was damages for a high-handed trespass; and the Jury having found in their favour, why should they not have damages? No statutory provision could be pointed to which ousted their right to damages. Substantial injury had been caused by the cutting off of the water, as the houses did not fetch so much when sold as they otherwise would have done; and there having been a breach of a common-law obligation, Mr. Justice Phillimore had enjoined the Company from preventing the plaintiffs connecting the houses with the main. The wrong done to them was not one for which a statutory penalty was provided; and, being outside the range of authorities, at the head of which stood the case of *Atkinson v Newcastle Water-Works Company*, it was not necessary to consider whether or not the remedy by injunction was ousted.

Lords Justices MATHEW and COZENS-HARDY concurred.

The appeal was dismissed, with costs.

COURT OF SESSION.—July 22.

(*Before Lord* LOW.)

The New Conveyor Company and their Patent.

It will be remembered that on the 23rd ult. [see "JOURNAL" for June 30, p. 973] Counsel for the pursuers in the action by the New Conveyor Company, Limited, against the Edinburgh and Leith Gas Commissioners, in which £2500 was sued for as damages for alleged infringement of patent in the construction of inclined retort-settings at Granton, and for interdict against continued infringement, moved Lord Low for a sist of the action in order that they might apply to the Patent Office for leave to disclaim the part of their patent relating to the shield which is placed in the mouth of the retort. Lord Low did not grant a sist, but said he would put the case out to have a diet of proof fixed in next session, which would give the pursuers time to make

application to the Patent Office. The case was accordingly put out by by his Lordship on the 16th inst.

Mr. CRAIGIE again appeared for the pursuers, and Mr. DUNCAN MILLAR for the defenders.

Mr. CRAIGIE moved for leave to make application to the Patent Office for a disclaimer.

Mr. MILLAR objected on the same grounds as before.

Lord LOW has issued his judgment, which is that, having heard Counsel on the motion of the pursuers for an order in terms of the 19th section of the Patents, Designs, and Trade Marks Act, 1883, authorizing them to apply to the Patent Office for leave to amend their specification by way of disclaimer, and for a sist of procedure in this action in the meantime, he refuses the said motion, dismisses the action, and finds the pursuers liable in expenses. His Lordship states that, in asking for authority to apply for leave to amend their specification, the pursuers admit that they cannot maintain the present action upon the specification as it stands. If the specification were amended, it is probable that the pursuers would require to ask leave to amend the summons and record; and, further, it is difficult to see how the pursuers could, in an action upon the amended patent, insist in their claim of damages for infringement of the alleged patent as it now stands. Under the Patents Act, 1883, it is entirely in the discretion of the Court whether leave to apply for an amendment of a specification by way of disclaimer should or should not be granted; and it is provided that if it is granted it shall be "subject to such terms as to costs and otherwise as the Court may impose." Now, as the reason for which the pursuers asked for an order for leave to apply for an amendment of the specification was that they were satisfied that they could not succeed in the action as laid, it seemed to him that the order could only be granted upon the condition that the pursuers should pay to the defenders the whole expenses already incurred by them. The question therefore arose; whether there was any sufficient reason for keeping the action in Court. The only reason for doing so would be that the pursuers might be thereby saved the cost of bringing a new summons. But the pursuers' Counsel did not dispute that the probable result of the proposed disclaimer, if allowed by the Patent Office, would be that, before the question of infringement could be tried in this action, it would be necessary to amend the summons. It did not follow, however, that the necessary amendment would be competent; and that was a question which had not yet arisen, and upon which he had no means of forming an opinion. In these circumstances, it seemed to him that it would not be fair to the defenders to keep this action hanging over them on the chance that the pursuers might obtain leave to amend the specification, and might also be found entitled so to amend the pleadings as to make them available for the trial of the question of infringement of the amended patent. He therefore thought that the proper course to follow was to dismiss the action, leaving it open to the pursuers, in the event of the specification being amended, to bring a new action.

Tynemouth Corporation Water-Works Arbitrations.

In the King's Bench Division of the High Court of Justice, on the 18th inst., Mr. Justice Wright had before him a special case arising out of arbitration proceedings between the Corporation of Tynemouth and the Duke of Northumberland, Sir G. O. Trevelyan, and Mr. William Orde, under the following circumstances: In March, 1901, the Corporation gave notice under their Water Act of 1898, and the Acts incorporated therewith, that they required certain lands belonging to the Duke and the other claimants, for the purpose of constructing the Font reservoir. The land belonging to the Duke contained about 85 acres, and formed part of a farm. It adjoined the land of the other claimants, abutting on the River Font. As the parties failed to agree as to the amount of purchase money, the matter was submitted to Mr. R. W. Cooper for arbitration. The Corporation contended that the land should be valued independently, and without regard to the fact that it adjoined land which formed the site of the reservoir. The Duke owned four-fifteenths of the land in the township in which the land taken by the Corporation was situated, and he claimed to have his land valued on the basis that it and that which belonged to the other claimants formed one site for the reservoir. The works of the Corporation would take five years, and the Duke said this would necessitate the erection of a voluntary school for the children of the workmen employed, the burden of which would fall upon him. The Arbitrator said that if the Court upheld the contention of the Duke, he was entitled to £6250, and £1600 for the school; but if it decided in favour of the Corporation, the amount would be only some £3600. Mr. Cripps, K.C., and Mr. Wood appeared for the Corporation; Mr. Balfour-Browne, K.C., Mr. Freeman, and Mr. Lloyd represented the Duke of Northumberland. His Lordship, in giving judgment, complimented the Arbitrator upon the clear manner in which the case had been stated. He thought the Duke was entitled to the higher amount named in the award; but as to the school, he was of opinion that the claim was too remote. Judgment was accordingly entered for the following sums: Duke of Northumberland, £6250; Sir G. O. Trevelyan, £3250; Mr. Orde, £2050.

Quality of Stockport Water.

At Wilmslow, last Thursday, Charles Sage, a photographer, of Alderley Edge, was summoned by the Stockport Corporation for not paying his water-rate. Defendant complained that the water was not good, and he produced a sample, saying the Corporation had broken their contract. The Clerk, however, advised that the question of the quality of water could not be gone into. He said that if a consumer thought his water was not satisfactory, he had a remedy in another form, and not as a set-off. He could sue for a penalty of £2 per day. Defendant submitted that, under the Public Health Act, a corporation or a company were bound to supply pure and wholesome water. The Bench declined to go into the question of quality, and made an order for the payment of the rate.

MISCELLANEOUS NEWS.

THE SULPHATE OF AMMONIA COMMITTEE.

At the Annual General Meeting of this Committee last Tuesday, at the Offices of the Gaslight and Coke Company, Fenchurch Avenue, E.C., the CHAIRMAN (Mr. W. G. Blagden) presided. There were also present Mr. Alfred Colson (Leicester Gas Department), Mr. F. J. R. Carulla (Sharon Chemical Company, Derby), Mr. A. Fraser (Pumpherston Oil Company, Glasgow), Mr. John Fyfe (Young's Paraffin Oil Company, Glasgow), Mr. Edward A. Harman (Corporation Gas-Works, Huddersfield), Mr. W. Love (Broxburn Oil Company, Glasgow), Mr. Thomas Milne (Gaslight and Coke Company, London), Mr. R. O. Paterson (Cheltenham Gas Company), Colonel S. A. Sadler, M.P. (Middlesbrough), Mr. Hanbury Thomas (Sheffield United Gaslight Company), and Mr. A. Stanley (of the Simon-Carvès Coke-Oven Construction Company, Manchester).

The minutes of the meeting held last year at Cork having been passed, the report of the Executive Committee was considered. The year covered by the report ends on June 30; and these are the Committee's remarks on the operations of that period—

The number of competitions carried out by Agricultural Societies for the Committee's prizes continues to increase each year; and during the period under review, no less than 99 competitions, or 14 more than in the previous year, were successfully concluded. Grain trials, in which the respective merits of sulphate of ammonia and nitrate of soda were tested, have also been carried out under the supervision of the Committee's Technical Adviser, who has likewise conducted cattle feeding trials with a view to demonstrating the superiority in the feeding value of turnips grown with the aid of sulphate of ammonia. All the competitions and trials have been attended by most gratifying results.

The report on the previous year's competitions and trials was issued in January, prior to the commencement of the manure season; and about 50,000 copies were distributed throughout the United Kingdom.

The Executive Committee were so satisfied with the benefits resulting from their having exhibited at the Glasgow and Cork International Exhibitions in 1901 and 1902, that they resolved to exhibit again at the International Exhibition which is being held at Cork this year. The Agricultural Section of this Exhibition is undoubtedly its most important feature; and a plot of land in the Exhibition Grounds has been placed at the disposal of the Committee by the Exhibition authorities for the purpose of carrying out manurial experiments. Various crops are being raised on this land with a view to demonstrating the results which can be obtained from the rational use of sulphate of ammonia in conjunction with other artificial manures. For purposes of comparison, adjoining plots have in each case been prepared from which sulphate of ammonia has been omitted from the mixtures of fertilizers employed. The Committee's attendant reports that these experiments are progressing most satisfactorily, and are already attracting a large amount of attention from agricultural visitors. Mr. Francis T. Cotton, of the Alliance and Dublin Consumers' Gas Company, has again kindly undertaken the supervision of details in connection with the Exhibition; and the Executive Committee once more record their deep obligations to him and Mr. J. Magrath, of the Cork Gas Consumers' Company, for the invaluable assistance they have rendered, and the time and labour they have devoted to the interests of the Committee.

The Committee exhibited a collection of roots, grains, &c., grown with the aid of sulphate of ammonia, at the Spring Show of the Royal Dublin Society, where a quantity of literature was distributed.

As in previous years, the Committee's advertisements appeared in the principal agricultural papers and periodicals during the continuance of the manure season. The Committee have not published any new literature in the past year. There has, however, been a re-issue of the pamphlet, "A Few Facts about Sulphate of Ammonia, by a Practical Farmer;" and "The Science of Manuring" has been revised and reprinted in a more convenient form.

It is a matter of considerable difficulty to arrive at an accurate estimate of the quantity of sulphate of ammonia annually consumed by agriculturists in the United Kingdom; but there is no doubt that the consumption is steadily increasing, and that in many districts where a few years ago the article was practically unknown it is now in general use. It is very gratifying to find that this contention is amply borne out by the replies received to inquiries addressed to the Secretaries of a large number of Agricultural Societies in the United Kingdom, who are unanimous in their opinion that sulphate of ammonia is now far more generally used, and that the competitions for the Committee's prizes have been the chief factor in bringing about this result.

Mr. CARULLA hoped the Committee would see their way to make a good show at the St. Louis Exhibition next year. It was well known that Great Britain made but a poor show at the last Paris Exhibition; and it was by no means desirable to repeat that error in 1904—especially in the proximity of Canada, and the certainty of a large influx from our other Colonies. It seemed to him, however, that although individually they could do very little, yet as a united body they might make a creditable display, of which they would all be proud.

Mr. BLAGDEN explained the difficulties in the way of making exhibits of the nature required, outside of the United Kingdom. It would be quite impossible to send over to the United States specimens of roots, &c., grown with sulphate of ammonia and retaining their freshness during the time of the exhibition.

Mr. HARMAN suggested that models might be used for the purpose.

Mr. CARULLA: Or photographs.

Colonel SADLER pointed out that when the Committee was formed, it was understood to be solely for the spread of information connected with the industry in the United Kingdom.

Mr. CARULLA admitted the strength of the argument, and said that although, consequently, he would not move any resolution, he still hoped the matter would be taken up individually from patriotic motives, and that the long run business benefit might result.

The report and accounts were then passed.

On the motion of Mr. CARULLA, who referred to the great services that its members had rendered to the industry, the Executive Committee were re-elected.

Mr. BLAGDEN said that, as they were aware, his connection having ceased with the Gaslight and Coke Company, he could no longer be regarded as a sulphate of ammonia maker; and it had been his intention to resign the Chairmanship of the Committee. But he had been so pressed by his colleagues to retain office that he had done so, and was willing to continue for another year.

This announcement was received with expressions of satisfaction.

Mr. FYFE moved a resolution of thanks to Mr. Blagden for his past services, in less regretful terms, he said, than he had anticipated having to do.

Colonel SADLER, in seconding the motion, added his quota to the tribute of the proposer.

Mr. BLAGDEN, in reply, modestly disclaimed some of the good things that had been said of him. He was, however, not left in any doubt as to the real gratitude felt by the members of the trade for his assistance in the endeavour that had been made to place the industry in its present sound position.

The proceedings then terminated.

INCANDESCENT GAS LIGHTING IN LONDON.

Recent proceedings at meetings of certain of the Metropolitan Borough Councils show that incandescent gas lighting is gradually extending. In connection with a general scheme for the improvement of the street lighting of Kensington, the Borough Council on Tuesday directed that the lamp columns in 39 streets and places should be fitted with "Kensington" pattern lanterns and incandescent gas-burners, at an estimated cost of £446 10s. Also that all the lamps not already converted in the district between Cromwell Road and Holland Park Avenue and High Street, Notting Hill Gate, should be fitted with incandescent gas-burners at an estimated cost of £130.

At the meeting of the Stepney Borough Council next day, the Engineer (Mr. M. W. Jameson) presented a report on the public lighting in which he stated as follows: "At the present time the Commercial Gas Company are supplying gas, keeping the lanterns glazed, fixing new burners when necessary, and painting lanterns and columns two coats each year, for the sum of £3 9s. per lamp per annum. The Company now offer to fit up at their own expense, with No. 4 Kern burners of 100-candle power each, the whole of the lamps in the principal thoroughfares, and to renew the mantles when necessary, the charges to be for the first 18 months the same as at present paid—viz. £3 9s.—and after the expiration of this time to reduce the charge to £2 18s. per lamp per annum, or a reduction of 11s. per lamp per annum. In the side streets they offer to fit up at their own expense, and renew the mantles when necessary, a No. 3 Kern burner, the charge to be £3 9s. for the first 15 months, and then reduced to £2 9s. per lamp per annum, or a reduction of £1 per lamp per annum. The cost of electric lighting by arc lamps averages for a 15-ampere lamp (as erected in the main thoroughfares) £19 14s. 8d. per annum for current and £6 17s. 6d. for maintenance—making a total cost of £26 12s. 2d. per lamp per annum; and the cost of a 10-ampere lamp averages £12 17s. 5d. for current and £6 17s. 6d. for maintenance, or a total of £19 14s. 11d. per lamp per annum." Mr. Jameson pointed out that, although the cost per lamp was far greater for electricity than for gas, the intensity of the electric arc lamp was more than twenty times as great as gas, while the cost was less than nine times; in other words, the cost per candle power for an electric arc lamp was about one-third the cost of gas of the same candle power. The cost of electrical incandescent lamps averaged £4 7s. 8d. for current and maintenance per lamp for the year ended March, 1903. This item, however, did not include the cost of fitting up and altering the lamp so as to make it suitable for lighting with electricity, which was estimated to be about £5 10s. per lamp. The cost of an electrical incandescent lamp per candle power was about the same as a flat-flame gas-burner, and double the cost of an ordinary incandescent gas-burner; and taking into account the Company's offer to reduce the price and increase the candle power of the incandescent gas-lamps, the cost per candle power for electrical incandescent lamps would then be about three times that of incandescent gas. The Council have already given instructions for the lighting of twelve streets with arc lamps, which will put out of use about 205 lamps, leaving 2910 to be dealt with by the Gas Company. With reference to the suggestion to fit a No. 3 Kern burner in the back streets, Mr. Jameson said: "About 20 per cent. of the lamps in the borough are now fitted with a No. 4 burner, and I now suggest that the side streets should be lighted with a No. 4 instead of a No. 3, as suggested by the Company, my reasons being (1) to get a standard price and standard size burner for the whole of the district, as different sizes and prices would, when breakages occurred, continually cause confusion; and (2) because the back streets and courts need a good light." He then went on to say: "Incandescent gas lighting in this borough in the past has not been altogether a success, as the heavy traffic ruins the mantles. The No. 4 Kern burner is an anti-vibrating burner, but does not prevent the mantles from being shattered, although it may be the means of increasing their life by a considerable period. The Company, however, are willing to undertake to renew the mantles when necessary, so that the illuminating power will be fairly maintained. The statement that the No. 4 Kern burner gives a light of 100 candle power is misleading. This is the light given when a new mantle is put on; but the vibration quickly causes the mantle to deteriorate. I think a fair average candle power is about 60. Should the Council decide to have No. 4 Kern burners fitted in the back streets, it would mean that after the 18 months at the present charge had elapsed, and the

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 225.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	April 17	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	May 14	6½	Bombay, Ltd.	5¾—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Feb. 26	12	Brentford Consolidated	240—245	..	4 18 0
286,700	,,	,,	9	Do. New	178—183	..	4 18 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	131—136	..	3 13 6
206,250	,,	June 11	4	Do. 4 p.c. Deb.	105—110	—2	3 12 9
220,000	Stk.	Mar. 12	10⅔	Brighton & Hove Orig.	212—217	..	4 19 1
246,320	,,	,,	7½	Do. A. Ord. Stk.	151—156	..	4 19 4
460,000	20	Mar. 31	10	British	39½—40½	..	4 18 9
100,000	Stk.	Mar. 12	6	Bromley, 5 p.c. "A"	118—123	..	4 17 7
165,700	,,	,,	4½	Do. 3½ p.c. "B"	90—95	..	4 14 9
500,000	10	May 14	7	Buenos Ayres (New) Ltd.	10⅝—11¼	..	6 4 5
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 10	8½	Cagliari, Ltd.	22—24*	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Feb. 26	5	Commercial 4 p.c. Stk.	103—106	..	4 14 4
503,750	,,	,,	4⅔	Do. 3½ p.c. ,,	98—101	..	4 14 1
407,812	,,	June 11	3	Do. 3 p.c. Deb.,,	87—90	..	3 6 8
800,000	Stk.	June 11	7	Continental Union, Ltd.	120—125	—5	5 12 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—142	..	4 18 7
575,000	Stk.	Feb. 26	5⅛	Crystal Palace Ord. 5 p.c.	113—118	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
106,158	,,	July 10	5	Do. 5 p.c. Deb. Stk.	135—138*	..	3 12 6
486,090	10	Jan. 29	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Feb. 12	4⅛	Gas-light and Coke Ord.	85—87	+2	5 1 2
2,600,000	,,	,,	3½	4 p.c. max.	85—87	..	4 0 6
3,799,735	,,	,,	4	3½ p.c. Con. Pref.	106—109	—½	3 13 5
4,193,975	,,	June 11	3	4 p.c. Con. Deb.	87—89	..	3 7 5
252,500	Stk.	Mar. 12	5	Coke 3 p.c. Con. Deb.	87—89	..	3 7 5
70,000	10	June 11	8	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
3,800,000	Stk.	May 14	10	Hongkong & China, Ltd.	15—16	..	5 0 0
473,600	Stk.	Feb. 12	3½	Imperial Continental	202—205	—1	4 17 7
165,242	Stk.	Mar. 12	6	Do. 3½ p.c. Deb. Red.	103—103	..	3 8 0
561,000	Stk.	Feb. 26	10	Lea Bridge Ord. 5 p.c.	115—120	..	5 0 0
718,100	,,	,,	7	Liverpool United A	218—220	..	4 10 11
306,083	,,	June 26	4	Do. do. B	166—168	..	4 3 4
75,000	5	June 11	5	Do. do. Deb. Stk.	110—112	..	3 11 5
560,000	100	April 1	5	Malta & Medn., Ltd.	4¼—4⅜	..	5 5 3
250,000	100	,,	4½	Met. of 5 p.c. Deb.	103—107	..	4 13 6
541,920	20	June 11	3½	Melbourne 4½ p.c. Deb.	102—104	..	4 6 7
1,515,892	Stk.	Feb 20	4½	Monte Video, Ltd.	9—10	..	7 0 0
376,855	Stk.	July 3	3½	Newc'tle & G'tesh'd Con.	104—105	..	4 5 9
300,000	Stk.	May 14	8	Do. 3½ p.c. Deb.	97—98*	..	3 11 5
600,000	5	Mar. 31	7	Oriental, Ltd.	140—145	..	5 10 4
				Ottoman, Ltd.	6—7	..	5 0 0
					* Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	June 26	6½	Ply'mth & St'house 5 p.c	123—128	..	4 15 8
851,070	10	April 30	7	River Plate Ord.	10¾—11¼	..	6 4 5
300,000	Stk.	June 26	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
250,000	10	April 17	8	San Paulo, Ltd.	11⅞—12⅛	..	6 8 9
135,000	Stk.	Mar. 12	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	237—240	..	4 3 4
523,498	,,	,,	10	Do. C	236—238	..	4 4 0
103,235	Stk.	Mar. 31	5	Shrewsbury Ord. 5 p.c.	111—114	..	4 7 9
6,000,000	Stk.	Feb. 12	5⅜	South Met., 4 p.c. Ord.	122—125	+2	4 5 3
1,780,000	,,	July 10	3	Do. 3 p.c. Deb.	89—91*	..	3 5 11
380,940	Stk.	May 14	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	July 10	4	Do. 4 p.c. Deb.	102—105*	..	3 16 2
120,000	Stk.	Feb. 26	6	Tottenham and Edmonton A. 5 p.c.	117—122	..	4 13 4
300,520	,,	,,	4½	Tottenham and Edmonton B. 3½ p.c.	96—99	..	4 10 11
182,380	10	June 11	8	Tuscan, Ltd.	8—9	..	8 17 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
730,872	Stk.	Mar. 12	5	West Ham, 5 p.c. Ord.	95—100	..	5 0 0
				WATER COMPANIES.			
780,776	Stk.	June 26	11½	Chelsea, Ord.	320—330	..	3 9 8
150,000	,,	,,	5	Do. 5 p.c. Pref.	147—150	..	3 6 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	135—138	..	3 5 3
175,785	,,	Mar. 31	4½	Do. 4½ p.c. Deb.	137—142	..	3 3 5
1,720,560	Stk.	Mar. 31	8	East London, Ord.	240—245	..	3 5 3
654,740	,,	June 11	4½	Do. 4½ p.c. Deb.	138—143	..	3 2 11
1,282,943	,,	,,	3	Do. 3 p.c. Deb.	93—96	..	3 2 6
700,000	50	June 11	10	Grand Junction 10 p.c. max.	138—143	—2	3 9 11
310,000	Stk.	Mar. 31	4	Grand Junction 4 p.c. Deb.	123—128	..	3 2 6
708,000	Stk.	Feb. 26	10½	Kent	300—310	..	3 7 9
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—210	..	3 6 8
1,043,800	100	June 26	11	Lambeth, 10 p.c. max.	310—320	..	3 8 9
406,200	100	,,	8½	Do. 7½ p.c. max.	220—230	..	3 13 11
350,000	Stk.	Mar. 31	4	Do. 4 p.c. Deb.	122—127	..	3 3 0
500,000	100	Feb. 12	12⅝	New River, New Shares	430—440	..	2 18 2
1,000,000	Stk.	Jan. 29	4	Do. 4 p.c. Deb.	123—128	..	3 2 6
902,300	Stk.	June 11	7½	South-wark and Ord.	270—275	—5	2 14 6
126 500	100	,,	7½	South-wark and 7½ p.c. max.	210—220	..	3 8 2
489,200	Stk.	,,	5	South-wark and 5 p.c. Pref.	148—153	..	3 5 4
1,019,585	,,	Mar. 31	4	Vauxhall 4 p.c. A Deb.	122—127	..	3 3 0
1,155,066	Stk.	June 11	10	West Middlesex	300—305	..	3 5 7
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	136—141	..	3 3 10
200,000	,,	Mar. 12	3	Do. 3 p.c. Deb.	94—96	..	3 2 6
					* Ex div.		

reduced charge of £2 18s. came into force, the Council would save about £1500 on the public lighting per annum. It must be clearly understood that the Company are to make all alterations to existing columns, brackets, and lanterns, so as to make them serviceable for incandescent gas lighting. In conclusion, I think the time has come when we should have a clear agreement with the Company on all matters appertaining to public lighting, and should endeavour to adopt a uniform system over the whole of the borough, as by so doing the lighting will be more satisfactory, and repairs executed with greater despatch." The principle of the report was approved; the opinion expressed in favour of a No. 4 Kern burner was endorsed; and the whole matter was referred back to the Engineer for him to compile and submit a list of streets.

MORECAMBE CORPORATION GAS SUPPLY.

At the Meeting of the Morecambe Town Council on Monday last week, the annual report and statement in regard to the working of the Gas Department was presented. It showed that the receipts on revenue account were £16,283, and the expenditure was £7823; leaving a gross profit of £8460—an increase of £2101, or 33 per cent., over the year 1901-2. The amount available for interest, redemption of principal, and income-tax was £9211, which left a deficit of £750 on the year's working, against a deficit last year of £1779; being a decrease of £1029. The principal repaid included £420, which should have been met out of the revenue account for 1901-2. The expenditure on capital account was £4159; making the total £173,690. The revenue from gas amounted to £12,503, an increase of £19. The gas unaccounted for was 8,936,990 cubic feet, or 11·5 per cent. of the make—an increase of 5·1 per cent., mainly due to the sewerage operations going on in the town. During the year, 1142 slot meters and 490 slot cookers were fixed free to consumers; the revenue from this source being £1960, or an excess of £1489. The receipts from coke showed a decrease, owing to the low price in the markets; but those from tar and ammoniacal liquor went up considerably, resulting in a net profit of £715, against £184 before.

Mr. BIRKETT, in submitting the report, said he thought it was a very satisfactory one. With the increase in the town, they might look forward to a larger consumption of gas. Although the capital expenditure had been raised by £4159, there was the fact that the whole of the borough had been laid with mains; and in a few years' time he hoped they would not only be able to reduce the price to consumers, but to contribute something to the rates. During the past quarter they had sold a million cubic feet more gas than in the corresponding quarter of last year. They had not taken anything from the rates this year.

Alderman BROWN said it was absurd to talk of not having taken anything from the rates, when there was a deficit of £750; and if it had not been for the contribution of £265 from the Sewerage Committee on account of leakage, the deficit would have been nearly £1100.

Mr. BIRKETT explained that what he meant was that nothing had been put down in the estimates as a charge upon the rates.

Alderman GARDNER said it seemed to him that what other Committees saved would have to go to the Gas Committee to help them out of their difficulty. If they could get the Council to give them £265 a year, they might well not estimate for anything from the rates.

Alderman BAXTER said if the Gas Committee did not make any charge on the rates, it was because they had a floating balance in the district fund account, and the deficit of £750 would come out of that.

Mr. GORTON said they had taken the £750 out of last year's balance to pay the deficit. This year no money had been asked for by the Gas Department; and that course was adopted on the distinct understanding that every effort would be made to avoid loss.

The report was approved.

BROUGHTY FERRY CORPORATION GAS-WORKS.

Report by Mr. W. R. Herring.

The Town Council of Broughty Ferry met on Wednesday last to consider the report of Mr. W. R. Herring, of Edinburgh, upon the condition of the gas-works. After stating that he has inspected the works, and investigated the affairs of the undertaking for a period of five years ending May 15 last, Mr. Herring says:

"Comparing the working results for the year 1903 with those of 1902, I find that there has been a most serious falling off both in the production of gas per ton of coal carbonized, and also in the available quantity of coke for sale, as well as a most serious diminution in the quantity of sulphate of ammonia produced. I am aware that your works were in a state of transition during the year under review; but after making full allowance for this, there is still a very large margin to be accounted for, and I may further remark that the reconstruction of the works and the starting of the new retort-bench could not in any way affect the results obtained from the sulphate of ammonia plant. During the year 1903, the coal used was of a very similar character to that used in the year 1902. In 1903, the average yield of 6655 cubic feet of gas was obtained from a ton of coal, as compared with 8100 cubic feet per ton in 1902. In 1903, 5 cwt. of coke was available for sale, as compared with 8 cwt. in 1902, and 10·63 cwt. in 1900. During 1903, 7·18 lbs. of sulphate of ammonia were yielded per ton of coal carbonized, as compared with 12·17 lbs. in the previous year. In short, had the results of 1903 been equal to those obtained in 1902, you would have saved 1710 tons of coal (equal in value to £777), you would have had 1527 tons of additional coke for sale (equal in value to £417), and an additional 21·85 tons of sulphate of ammonia (equal in

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	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	25,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

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MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.

value to £201). In other words, your revenue would have been increased by £1395, or by 5¼d. per 1000 cubic feet made. The premature break up of the new retort-settings will doubtless account for a considerable proportion of the lesser yield of gas from the coal used as compared with 1902. When I inspected these settings, partly in work on June 13, I found them to be in very bad order; and when again investigating the matter on July 8, I found evident proofs of a large quantity of gas having passed through the regenerative chambers and into the flues. I then made a thorough examination of the retort-settings, two of which had been partially dismantled in accordance with my suggestions when first visiting your works, to enable me to make a thorough inspection of the interior of the settings; and I found that there had been considerable local heating beneath the centre retort in what is termed the combustion chamber. The silica material used in this part of the work had in many places been completely fluxed; and it is primarily in consequence of this fluxing and softening, or partial melting, of the fire-brick work that supports the retorts, that the latter have given way, allowing the retorts to sink, and consequently tumble to pieces.

"The entire absence of any systematic record at the works of the weight of coal used per day, or per week, or even per month, has made it quite impossible for me to discover the exact conditions under which the new retorts were worked. I am also unable to ascertain how much coal was charged into the new, as distinct from the old, as both were working at the same time, and the resulting gas mixed together before measurement. The exact cause of the failure of the new work in so short a time is not easy to explain. Structurally, I do not approve of the method adopted for conducting the heat gases from the producer and the mixing therewith of the secondary air supply. The area is too much restricted, and the flame too much impeded in its access to the setting. This is no doubt the reason why the silica brickwork in this part of the setting has melted and given way; but I must say that it also appears to me that the settings have been forced to do a greater amount of work than they were properly capable of doing, either by working too heavy charges, or probably as a result of large deliveries of wet coal—the class of coal you have been in the habit of using latterly being very much in the nature of a sponge, holding in suspension a very large quantity of moisture. This wet coal would also in itself do serious damage to the retorts. It must not, however, be forgotten that other towns were subjected to the same climatic conditions, and that the general practice is to use the coal arriving at the works. It is a highly dangerous practice to put wet coal to stock; and if this is small coal, it is almost certain to fire from spontaneous ignition under such conditions. The reserve stock should simply be taken advantage of when direct deliveries fail to make their appearance. The same class of coal was also doubtless used in the old retort-house without such disastrous results to the settings.

"The very large amount of coke used on the works during the year as compared with 1902—which in itself is larger than 1901—goes to show that the working of the retorts generally was less satisfactory than in former years. Some allowance must, however, be made for the coke used in connection with the constructional work, the first lighting up and drying of the new settings, and also the quantity used in the electric light boiler, for none of which purposes has any record of the quantity used been kept. The supply to the Electricity Department should certainly be weighed. The best type of retort-setting requires from 2 to 3 cwt. of coke per ton of coal carbonized. The coal you are using will yield (say) 12 cwt. per ton; and as you have only produced 5 cwt. available for sale, 7 cwt. have to be accounted for under the headings as above. The low yield of sulphate of ammonia cannot in any way have been the result of the former adverse conditions. On the average, 25 to 28 lbs. of sulphate of ammonia is yielded per ton of coal carbonized. The class of coal you are using may not be as rich in ammonia; but in the absence of any record as to the quantity of liquor produced, I am unable to say. But 15 lbs. would be an exceptionally low yield. In 1902, you obtained 12·17 lbs.; whereas in 1903 only 7·18 lbs. was recovered. The only reason I can suggest for this is that either your liquor storage tanks are leaky or the liquor has passed through the stills without being properly treated. I have suggested verbally that the tanks should be tested for tightness."

After referring to the amount of acid used in the production of sulphate, Mr. Herring continues:

"I suggest that you should carefully check your weights and delivery notes, as I can see nothing wrong with your plant; and while the ammonia may have been allowed to run down the drain in the effluent liquor (on each occasion when I had it tested I found such to be the case), the acid, being in a separate vessel, cannot get access to the drain. The only source of escape is through a leaky acid storage tank. This tank should therefore be tested for tightness, and meantime the plant stopped until proper arrangements can be made for its systematic working under different conditions, which I will hereafter enumerate. Taking a still broader view of your affairs, and comparing the working results during the past five years, I find that the cost of the gas per 1000 cubic feet for materials used, less money received for the residual products (coke, tar, and sulphate or liquor sold), stands in the following order:—

Year.	Price of Coal and Oil or Spirit.	Net Cost of Gas.
1899	13s. 7d.	11·23d.
1900	18s. 0d.	10·84d.
1901	18s. 0d.	11·3d.
1902	10s. 11d.	9·21d.
1903	11s. 0d.	1s. 3·29d.

"The above statement does not take into account either the wages or the amount of money spent on general repairs or repairs to retorts, as these items during the period under review have shown very wide fluctuations. From these figures, I think you will agree that the initial price of coal is of only secondary importance as compared with the actual results obtained. Take, for instance, the years 1902-3, when the price of coal was practically the same, it cost in 1903 1s. 3·29d. per

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1000 cubic feet of gas, as compared with 9·21d. in 1902; the difference of practically 6d. per 1000 cubic feet resulting entirely from the inferior results obtained in the past year.

"I have already suggested that you should abandon the use of coal such as has been used during the past two years. In the first place, it is but a poor grade gas coal, producing but little gas, and containing a large percentage of ash, as well as liable to carry a large percentage of moisture, which is all paid for at the rate of so much per ton. In my opinion, not more than 66 per cent. of the coal used is really available for gas-works purposes; the remainder being represented by moisture and ash. To obtain the same results, therefore, as another works carbonizing an average grade gas coal, you must use 33 per cent. more coal to produce the same results. Your labour is of necessity 33 per cent. more, and 33 per cent. more of your plant must be employed to yield the quantity of gas in the same period of time. Under conditions such as this, it therefore stands to reason that your results cannot be as economically produced as when using a raw material of a much higher initial gas value; and I would strongly advise you to abandon the use of the coal you have been using so largely during the past two years, and rather revert to the practice which prevailed in the year 1900. You then produced 10,233 cubic feet of gas per ton of coal, as compared with 6655 feet in 1903 per ton of coal and benzol used. I understand there may be some difficulty in cancelling the contracts you have already entered into; but negotiations might result in your being able to either reduce the quantities or spread their deliveries over a longer period than one year, by which means you would be able to procure some of the better class coal and mix the two together. Under any circumstances, however, the reconstruction of the new settings, together with the closest supervision and the check on working I will after explain, will enable you to improve the results and consequently to economize on the present year's working to the extent of £750, on which figure you will be quite safe in basing your immediate calculations as to the price to be charged for gas during the coming year.

"The cost of reconstructing the settings, which I roughly estimate will be about £400, is, however, strictly speaking, a revenue charge. During the year 1900, you spent £145 15s. on repairs to retorts; 1901-2-3, however, only absorbed £123 altogether. On the basis of 1900, you would have been justified in spending £435 during the three years. Having only spent £123, it leaves a balance of £312 to the good. Under the circumstances, therefore—which may be justly termed as unfortunate and exceptional, and might be characterized as in the nature of an accident—I am certainly of opinion that you will be justified in spreading the cost of removal over a period of at least two years. The renewed retorts, if properly worked, will last three years, with but a few pounds expenditure per annum.

"I have refrained from dealing with the works structurally, as this did not come within the scope of my original instructions, though I have both verbally and by letter dealt with some questions affecting it. Neither have I dealt with your works from the point of view of capacity in relation to the present and probable future demands for gas, as this will be considerably influenced by the quality of coal used. These points, however, can be easily dealt with, from the information I already have, hereafter, should you wish me to give attention to these matters."

The report concludes that certain instructions with regard to the gas-making operations should be immediately put into force, and that in the meantime the sulphate of ammonia plant should stand idle; the ammoniacal liquor being allowed to accumulate in the storage tank.

The Town Council sat in private. It is intimated that Bailie Lindsay gave notice of motion in the following terms: "That the Town Clerk be instructed to call a special meeting of the Town Council, to be held within the Board Room, Municipal Buildings, on the evening of Tuesday, Aug. 4 next, at 9 o'clock, to consider the motion then to be made that the services of Mr. Forbes Waddell, as Gas Engineer and Manager and Manager of the Electricity Department of the Town Council, and in all and every other office held by him under the Town Council, be dispensed with as from the said 4th of August, and that he be allowed three months' salary as from said date in lieu of warning and in full of all claims of any kind at his instance against the Town Council."

METROPOLITAN WATER BOARD.

A Meeting of the Board was held last Friday at the Offices of the Metropolitan Asylums Board—Mr. R. M. Beachcroft in the chair.

The General Purposes Committee presented a report with reference to the arrangement sanctioned with the London County Council to continue till Oct. 31, at the Board's expense, their examination of the water supplied to London. Dr. Clowes, the Council's Chemist, had made his report for June, in which he stated that his bacteriological and microscopical examinations of the filtered water had shown it to be of inferior quality as compared with that usually supplied; and he remarked that the effect of this and previous reports was to show grave deficiency in storage reservoirs. The report was received.

The Special Arbitration Committee, over which the Chairman of the Board presides, brought up a report in which they stated that the time had arrived for them to give some account of the progress made with the work entrusted to them. Five eminent counsel, three engineers, and three firms of accountants had been engaged on behalf of the Board. The Solicitors had also been authorized to secure the services of four well-known local engineers to assist in the investigation of several of the special cases, and three bacteriologists had been employed to make examinations of samples of water in connection with the recent flood; while a geologist had been secured to report on the question of the supply of water from deep wells. These experts had been busily engaged since the appointment of the Committee. Preliminary reports had been received from the accountants and engineers; and it was confidently expected that within the next ten days information would be before the

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Committee of such a definite character as to enable them to submit for approval the draft answers to the claims of the Companies and District Councils. The orders of the Court of Arbitration required that on or before the 17th of August the Board should deliver to the Secretary of the Court six copies of their answer to the claim of the East London Water Company, and thereafter, at successive intervals of one week, and in a certain order, answers to the claims of the other Companies and of the District Councils of Tottenham and Enfield. The sittings of the Court for the purpose of hearing the claims would commence on Monday, Oct. 26. The order made by the Court provided that each answer "shall set forth the amount of compensation which the Board is willing to pay to the Company or Council, together with a concise statement of any relevant facts" The Counsel of the Board were engaged in settling such a statement as might be applicable to the case of each claim. The Committee expected to be furnished with this as well as with the reports of the engineers and accountants by the end of the month, and to be able to lay the draft of the proposed answers before the Board at a special meeting, which they recommended should be held on Aug. 7.

A memorandum, giving useful information with regard to the undertakings of the Water Companies and of the two District Councils, including summaries of the claims delivered, has been compiled under the direction of the Chairman, and they have given instructions for it to be printed and circulated among the members.

In conclusion, the Committee reported that the London County Council had authorized their Water Committee to allow the Board to inspect the documents in the Council's possession relating to the London Water Question, and to supply or lend any of such documents to the Board.

The report was received and the recommendations agreed to.

DEVONPORT WATER ARBITRATION.

July 24 and 25.

(*Before Sir* FREDERICK BRAMWELL, F.R.S., *Umpire.*)

This arbitration, to determine the price to be paid by the Corporation of Devonport for the undertaking of the Devonport Water Company, was resumed at the Westminster Palace Hotel on Friday after an interval of about three months.*

Mr. CHARLES HAWKSLEY was Arbitrator for the Company; Mr. G. H. HILL for the Corporation. Mr. BALFOUR BROWNE, K.C., Mr. DUKE, K.C., and Mr. CLAVELL SALTER appeared for the Company; the Hon. J. D. FITZGERALD, K.C., Mr. HONORATUS LLOYD, K.C., and Mr. BODILLY represented the Corporation.

The inquiry was reopened for the purpose of hearing evidence upon the point as to the terms of supply to the Admiralty. Under an old Act, the Company had to supply Devonport Dockyard with as much water as could be got through a pipe of a certain size; and the question now raised was whether the yard in the early days embraced the Keyham and other extensions which have been made since the Act was passed. The Company maintained that it did not; and the case for the Corporation was that it did. Several witnesses were called and examined; their evidence being chiefly of a topographical character, illustrated by reference to maps of the particular locality.

Mr. *Stone*, of the Surveyors' Department of the Admiralty, was called by Mr. FITZGERALD, and examined upon the point of the extent of the dockyard. He said the Admiralty regarded the Keyham Yard, the seamen's barracks, the engineer students' recreation-ground, and the Port Admiral's house as within the boundaries of the yard. He produced a War Office book bearing upon the position of the establishment at Keyham Point, and it showed that the Point was in the hands of the Ordnance Department, having been purchased during the reign of George III. It was occupied at one time by magazines and other buildings. The land was now in the hands of the Admiralty.

Witness having been cross-examined by Mr. BALFOUR BROWNE,

Mr. FITZGERALD said he would not call any other witnesses. He then addressed the Court for the Corporation, and dwelt upon the construction which must be put on section 20 of the Act of 1793, under which the Company were compelled to supply the dockyard. He urged that the evidence of Dr. May proved that in his early days the town of Plymouth Dock, in popular phraseology, included the parts both inside and outside the lines. In the early part of the last century, it was plain that the magazine at Keyham Point was inside the lines; and certain land upon which the magazine stood was described in an Act of 1774 as being at Plymouth Dock. He contended that various lands occupied by the Admiralty and in the vicinity of the dockyard had been constantly described as being within the town of Plymouth Dock; and upon this ground the Corporation based their claim that the Company were bound to supply the requirements of the Admiralty beyond the actual area known as the dockyard.

Mr. BALFOUR BROWNE, on behalf of the Company, argued that the evidence had shown that the whole of the dockyard, as mentioned in the Act of 1793, was contained within the lines of fortifications which existed. The Admiralty had made contracts in the separate cases for supplemental supplies of water to establishments not within the lines; and they had never repudiated these contracts. It was not likely, he maintained, that they would have paid for these supplies if they had been entitled to get them free of charge. The Corporation now wanted to knock off £90,000, the capitalized value of this portion of the undertaking. Having quoted from the Act of 1793, Counsel contended that the Company were bound to supply water to the Ordnance offices, the residences, to the troops quartered in the barracks, and the gun wharf inside the lines. These establishments were all connected with the War Office. The Admiralty were dealt with in a separate section (the 20th) of the Act, which laid down that water should be supplied to the dockyard at the town of Plymouth Dock and to ships also, as required by the Admiralty. Mr. Fitzgerald had admitted that the dockyard was

* See "JOURNAL," Vol. LXXXII., p. 311.

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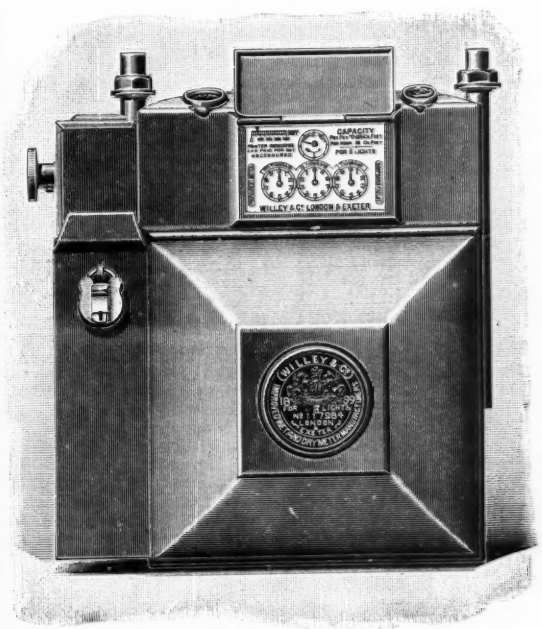

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wholly within the lines; and if this was so, how could he say that the Company were bound to supply water to other establishments which were outside the lines? What he asked the Court to consider was which, if any, of the ten places for which the Admiralty had paid for supplemental supplies came within the words "the dockyard at the town of Plymouth Dock." Counsel mentioned that the Admiralty are now constructing works at the Cattewater on the other side of Plymouth, which came under the same office as the dockyard. Was it suggested that the Company should also supply these works with water?

Mr. DUKE: They will ask the Company to supply the Admiralty at Whitehall next.

Mr. FITZGERALD said they could not lay the pipes.

Mr. BALFOUR BROWNE contended, in conclusion, that the Admiralty had properly and honestly paid for the supplementary supplies they had had; and he asked the Court to find to this effect.

At the termination of the legal arguments, the Umpire reserved his award.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I learn that, in my somewhat introspective note last week regarding the working of the Edinburgh and Leith gas undertaking in the past year, I failed to mention a condition of working which is new, and which supplies the explanation of the result which it is evident was in my mind when I used the words "however it is to be accounted for" in speaking of the increased consumption upon a lessened output. This condition is to be found in the circumstance that, for the first time, the quantity of gas registered was corrected to the standard temperature and pressure, and also that a more permanent gas is now made than hitherto. As a matter of fact, gas has been registered at a very much higher temperature than the normal, which gave a larger output, but with resulting loss; and this showed an apparently large leakage. The correction now made accounts for fully 3 per cent. of the reduction of unaccounted-for gas. I am glad to be able to make this explanation, because it shows that the improvement in the results was not due to anything connected with the distributive plant, but to something inside the works; and it removes the possibility of forming the erroneous impression that the lesser yield per ton of coal was due to the working at Granton. So far from the latter being the case, the yield at Granton is an improvement upon what was obtained in the old works. This is what was intended when the works were designed; and it is highly satisfactory to know that the new works are in every way fulfilling expectations.

It will be observed from the "Legal Intelligence" column of this issue of the "JOURNAL," that the Edinburgh and Leith Gas Commissioners have obtained a favourable decision from Lord Low of the action brought against them by the New Conveyor Company, Limited, regarding their inclined retort installation at Granton. The decision does not foreclose the question at issue; it simply embodies his Lordship's opinion that the action as laid cannot proceed. In other words, Lord Low refuses to consider whether an infringement has or has not taken place until it has been authoritatively fixed what is intended to be covered by the patent. The venue is changed for the time being to the Patent Office. It is not likely that the New Conveyor Company will find any opposition there, seeing that they propose to give up something, as they would most probably do if they were claiming something; and they may return to the Law Courts with a patent which is purged, and which they are prepared to stand up to In that case, having removed part of their specification which they admit they could not have stood by, it will be more difficult for the Gas Commissioners to meet them. But there is another consideration which is not altogether irrelevant to the question—that is, how far any disclaimer they may make will affect existing royalties they may be receiving. If part of the patent be given up, it is reasonable to suppose that those who may be paying royalties for the use of the whole invention as now claimed may want to be relieved of part of their burden. In this view, success in their latest step would apparently open up a vista of difficulties which they do not seem to have anticipated when they brought their action against the Edinburgh and Leith Commissioners.

Another great blank has been made in the ranks of gas managers in Scotland by the death on Saturday last of Mr. James Thomson, of Inverness. Placed as he was, Mr. Thomson had not the opportunity for developing qualities which are accounted great; for the undertaking he had control of could not bear the cost of vast schemes of renovation. But he had all-round qualities which made him capable of turning to the best account whatever might be in his hand, as anyone must have had borne in upon his mind who saw his works. In this he was truly great—that he managed his undertaking for the benefit of the Corporation, striving with uprightness and integrity to render the best service he could. This method of management was greatly appreciated by his employers, as well it might be; for, by well thought-out, if simple, economies, he saved them much outlay, and secured great gain to the community. As a friend he was incomparable. Who can ever forget his hearty and heart felt greetings? He has given three sons to his profession, which is a good record; and, indeed, of his whole family life it may be said that its joy was unclouded till a few weeks ago, when his partner in life was suddenly taken from him. In this home felicity he was probably found at his greatest and his best.

It is with feelings of no ordinary regret that I read the report of Mr. W. R. Herring, of Edinburgh, upon the condition of the Broughty Ferry Gas-Works. While it was not disclosed, there was room for hoping that something might be discovered which would point to the unsatisfactory working of the past year being due to causes so occult as to have been practically beyond the ken of the ordinary manager. But I am afraid that Mr. Herring's masterly inquiry into the subject leaves no room to question the causes, and that they were such as should have been detected almost as soon as they developed. It is but right

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to mention that Mr. Forbes Waddell, the Manager, has had the care of the electric light undertaking added to his other duties; and it is possible that, his attention having been taken up with that department, his duties as Gas Manager were not performed with the care which they would have been had he not been otherwise occupied. The Town Council have not disposed of the report as yet; and as Mr. Waddell has not been heard upon it, further comment at present would be out of place. Though, as I have said, Mr. Herring's conclusions seem to be incontrovertible, yet Mr. Waddell may have explanations to offer which would alter the conclusions that might be arrived at when only one side of the question is known. I hope that this is so, and that the Town Council may not find it to be their duty to go the extreme length which is foreshadowed in the notice of motion that has been given. The situation is a very trying one, both for the Corporation and for Mr Waddell; and it is to be hoped that mild counsels will prevail.

At a meeting of the Falkirk Town Council on Monday, the report of the Manager (Mr. J. Kincaid) upon the working of the gas undertaking for the past year was submitted. It stated that the quantity of gas manufactured was 142,517,500 cubic feet—an increase of 11,743,300 feet over the previous year, or at the rate of 8·98 per cent. The quantity accounted for was 125,345,000 cubic feet—an increase of 10,357,500 feet, or at the rate of 9 per cent. Unaccounted-for gas was equal to 12·05 per cent, as compared with 12·07 per cent. During the year, 14,971 tons of coal were carbonized, yielding, on an average, 9520 cubic feet of gas per ton, as compared with a yield of 9250 cubic feet in the previous year. Coke and breeze sold amounted to 7176 tons, or 1054 tons more than in the previous year. Tar and liquor sold equalled 800,746 gallons, being 53·48 gallons per ton of coal carbonized. The condition of the works is much the same as a year ago; the plant being upheld in the same repair. The mains were extended by 744 yards, 480 yards were enlarged or renewed, and 102 new services were laid and connected. The number of new or repaired meters fitted in during the year was 852, while 469 were brought into the works; showing an increase in the number of consumers of 383, as compared with 339 the previous year. Of the 383 new consumers, 289 were ordinary and 94 prepayment. The number of consumers on May 15 last was: Ordinary 5186, prepayment 1548, total 6734. The Gas Committee reported that negotiations had been reopened with the North British Railway Company with a view to ascertaining what railway facilities could be obtained for new gas-works. Mr. H. Russell, the Convener of the Committee, remarked that there were two outstanding features in the report of the Gas Manager. One was the largely increased results got in the quantity of gas manufactured and the bye-products, as compared with former years; and the other was the rapid increase in the consumption of gas, which was going on notwithstanding the fact—and he was sorry to say it—that they were doing all they could to keep it back. As regarded the proposal to introduce the benzol process, he might mention, on the principle of giving honour to whom honour was due, that it originated with Mr. Neilson and his Special Committee. As to the question of a site for new gas-works, as there was to be a change in the management, he would not have brought the matter up in the meantime, except for the fact that their time for acquiring the ground scheduled in the Act of Parliament would expire within a week or two. They had met a representative of the Railway Company in an unofficial capacity; and the owners of the ground they had in view had most generously agreed to give them an extension of time for three months, in order that they might agree with the Railway Company before purchasing the land. Upon this statement, some of the members thought that what was referred to was the Thornhill site, which they understood had been abandoned. On this subject there appeared to be dubiety as to whether the Railway Company held it to be abandoned; and upon the other point, it was mentioned that three sites were under consideration. Upon these assurances, the proceedings of the Gas Committee were approved of. As to the question of site, either nothing has been done, which would be the correct policy, or a great deal more has been done than is supposed, in the fixing of Thornhill as the site. Such are the ways of municipal diplomats, that it is just possible it may turn out, when the time for decision comes, that the erstwhile despised Thornhill was the only site which was really in the view of the inner circle, and that the proposal to inquire into the merits of other sites was never intended to go beyond inquiry.

The Council had twenty-four applications for the post of Gas Manager, which is to be vacated next month by Mr. Kincaid. The Gas Committee reduced these to the following six: Messrs. Ralph E. Gibson, Huddersfield; Wm. M'Crae, Edinburgh (late of Dundee); Geo. Keillor, Peterhead; W. M. Ruxton, Carnarvon; T. Blackadder, Falkirk; and R. Halkett, Bedford. The Committee asked, and were granted, power to reduce the leet to three; and the following have since been selected: Messrs. Gibson, M'Crae, and Keillor. These are to be reported to a special meeting of the Town Council; but some of the members have indicated that they claim the right to nominate some who are not on the short leet.

The Largs Gas Company have paid a dividend at the rate of 6 per cent. for the past year, and have reduced the price of gas from 5s. to 4s. 7d. per 1000 cubic feet. On the part of some of the shareholders, complaint was made that depreciation of the works was not being attended to; and it was, somewhat unfairly I think, left to the Directors to say whether they will take their remuneration, amounting to £70, or apply it to depreciation.

The Corporation of Gourock have reduced the price of gas to consumers inside the burgh from 3s. 8d. to 3s. 4d. per 1000 cubic feet, and to consumers outside from 5s. 6d. to 5s. 2d.

The Hellifield and District Gas Company, Limited, has been registered with a capital of £7000, in £1 shares, to manufacture, sell, and supply gas for light, heat, and motive power at Hellifield, Yorkshire, or elsewhere in England, and to carry on the business of gas-works proprietors, manufacturers of and dealers in coke, sulphate of ammonia, coal tar, pitch, asphaltum, ammoniacal liquor, and other products of the manufacture of gas, manufacturers of gas burners, stoves, engines, and fittings, &c. There will be no initial public issue. The registered office is District Bank Chambers, Bradford.

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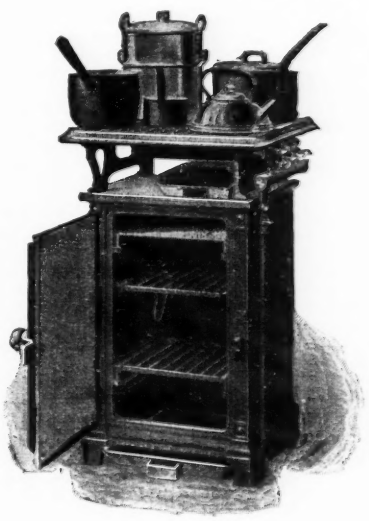

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 25.

Sulphate of Ammonia.

There has been no recovery from the depression of the past few weeks, but, on the contrary, a further decline in values; the closing quotations being £12 7s. 6d. per ton f.o.b. Hull, £12 10s. per ton f.o.b. Liverpool, and £12 12s. 6d. per ton f.o b. Leith. There has been no large supply offering; but the spot market is dominated by forward speculative selling at a discount, and buyers who have requirements to cover are postponing their operations to the latest possible moment. For delivery ahead, makers generally are quoting £12 10s. per ton; but this price is not obtainable, there being speculative offers abroad at the equivalent of fully 5s. per ton less.

Nitrate of Soda.

This article is firm in all positions, and spot prices have been advanced to 9s. 9d. per cwt. for ordinary and 10s. for refined quality.

LONDON, *July* 24.

Tar Products.

The markets generally are quiet; and there is not much doing for either present or forward delivery. Pitch continues very quiet; and there is an absence of demand for prompt delivery, which tends to slightly reduce prices. Business is, however, reported over 1904 at a fairly good figure, although, of course, under the prices ruling for early delivery. With regard to benzol, the demand for special qualities for gas enriching continues fairly strong; and as not much is being produced at this time of year, the market remains steady. But there is an absence of Continental demand. In toluol and solvent, there is nothing fresh to advise. There is absolutely no business doing in either of the articles. The demand for 60's crude carbolic continues good at 1s. 6d. per gallon, at which price a fairly large business is reported for July-September delivery. In crystals, there is very little doing. The German manufacturers are evidently accepting lower prices than the English makers. The position of anthracene remains unchanged. There is very little offering for prompt; while as regards forward, makers will not consider business except at higher prices than those at present ruling. In creosote, there is very little doing in the North; but in London a fair demand prevails for liquid oil. The prices which are being realized for tar are still very high; and competition continues strong in all quarters, but especially in the North of England.

The average values during the week were: Tar, 23s. 6d. to 33s. Pitch, London, 55s. to 55s. 6d.; east coast, 53s. to 53s. 6d.; west coast, 51s. to 52s. Benzol, 90 per cent., 8½d. to 8¾d.; 50-90 per cent., 7d. Toluol, 6½d. to 7d. Crude naphtha, 2½d. to 3d.; solvent naphtha, 7d. to 8½d.; heavy naphtha, 9d. Creosote, London, 1¼d. to 1⅜d.; North, 1⅛d. to 1¼d. Heavy oils, 2d. to 2½d. Carbolic acid, 60 per cent., 1s. 6d. Refined naphthalene, £5 to £8 10s.; salts, 22s. to 25s. Anthracene, "A" quality, 1¾d. to 1⅞d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market is very dull, with an absence of inquiry. Beckton now quote £12 12s. 6d.; but there are no buyers at this price. In fact, it is very uncertain whether £12s. 10s. could be realized for prompt delivery. As regards Leith, £12 10s. is now the market price; but even at this buyers do not take any interest in the market. In Hull, there are still sellers at from £12 7s. 6d. to £12 8s. 9d.; but buyers offer only £12 5s. for prompt shipment, and do not seem at all anxious to purchase even at this price. There is an entire absence of business for either prompt or forward delivery; and values have decidedly a downward tendency.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The settlement of the Manchester Corporation contracts brings to a close practically all the important season's gas coal trade in this district. These contracts (for which we understand something like ten times more coal was offered than was required) have been concluded on pretty much the same basis as the bulk of the large contracts put through this year—that is, a reduction of quite 6d. per ton upon 1902 prices. The fact that so much more coal was offered than required is not in itself a matter upon which too much stress need be laid, as frequently collieries tender for much larger quantities than they expect to secure or perhaps would be able to deliver. It may be taken, however, as an indication that the common qualities of round coal suitable for gas making purposes are generally plentiful, and that there is an eagerness to sell, even at the reduction upon last year's rates. No material change can be noted on the quoted prices given in our last week's report; the general basis remaining about 8s. 3d to 8s. 6d. per ton at the pit for common, up to 8s. 9d. and 9s. for the better qualities of screened Wigan four-feet, with screened Wigan Arley ranging from 9s. 3d. and 9s. 6d. for ordinary descriptions, up to 9s. 9d. and 10s. for the very best qualities. Other descriptions of round coal used for steam, forge, and general manufacturing purposes are in ample supply to meet requirements; and on prompt clearance sales, there continues to be some low cutting to secure orders of any weight. For inland sale, as low as 7s. 6d. and 7s. 9d. per ton is being taken in some cases, with 8s. 3d. to 8s. 6d. representing the ordinary quotations, and better qualities going up to 8s. 9d. For shipment, also, prices continue to be cut very low where immediate clearances can be made, and 8s. 6d. to 8s. 9d. are reported as the figures at which there have been sellers, with ordinary quotations for good qualities of steam coals about 9s. 6d. to 9s. 9d. delivered at the ports on the Mersey. The better qualities of round coal, which are still moving off very slowly for house fire purposes and accumulating in stock, notwithstanding pits are not working more than three to four days and in some cases less, remain without quoted

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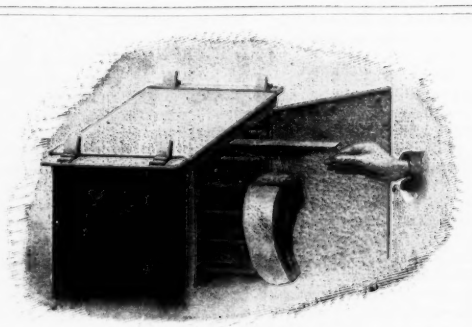

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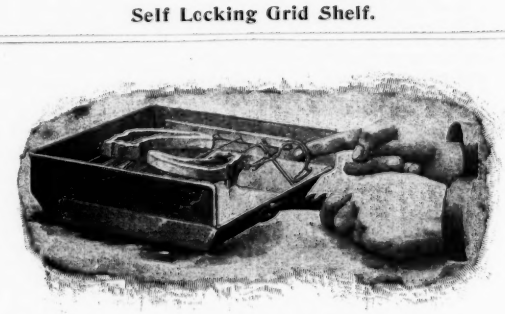

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change so far as the list rates are concerned. The prices are about 14s. and 14s. 6d. per ton at the pit for best Wigan Arley, 11s. and 11s. 6d. to 12s. for seconds Arley and Pemberton four feet, and from 9s. 6d. to 10s. 6d. for the lower qualities of house coal. At the pit mouth, best slack is steady at about 6s. 6d. to 6s. 9d. per ton, medium sorts 5s. 6d. to 6s., and very inferior descriptions as low as 3s. 9d. and 4s. up to 4s. 6d.

Northern Coal Trade.

In this district there is a steady general demand, though one or two of the second-class collieries have an occasional idle day. In the steam coal trade, there is a good inquiry for best Northumbrian. The price is steady at from 10s. 7½d. to 10s. 9d. per ton f.o.b., second-class steams are about 9s., with a fair demand, and steam smalls seem to be plentiful at 5s. 3d. to 5s. 6d. In the gas coal trade, there is a rather better demand; and the shortening days will soon begin to tell on the consumption. Durham gas coals vary in price from 8s. 6d. to 9s. per ton f.o.b., according to quality. No heavy contracts are reported this week; but one or two for export are under negotiation, and will help to take up the output until the London demand is greater. The coke trade is steady; but as the production of gas coke is now beginning to increase, there is no pressure in the demand. Good gas coke is from 12s. 6d. to 13s. 9d. per ton f.o.b. in the Tyne; and there are only very limited stocks. It is said that some exporters ask as high a figure as 14s. 9d. per ton for early export.

Scotch Coal Trade.

This being holiday time in Scotland, the Glasgow Stock Exchange has been closed, and no report can be furnished as to trade. The shipments for the week amounted to 233,307 tons—an increase of 10,760 tons upon the previous week, but a decrease of 1042 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,812,559 tons—an increase of 138,269 tons upon the same period of last year.

Sale of Shares.—At Newcastle, last Tuesday, Mr. Charles A. Joel sold by auction £60,000 of ordinary 7 per cent. stock of the Newcastle and Gateshead Water Company, at prices ranging from £144 to £149 10s. per £100 of stock.

Merthyr Water-Works Rating Appeal.—At a meeting of the Water Committee of the Merthyr District Council on Wednesday, it was reported that on the day when the appeal of the Council against the rating of their reservoirs, &c., was heard, a compromise was effected, with the result that the gross ratable value was put at £5335, and the net at £4850, instead of £7074 and £6431 respectively.

The Finances of Dewsbury.—There was issued on Friday an abstract of the accounts of the Dewsbury Corporation for the year ended March 31 last. It shows that the total liabilities of the borough amount to £903,644, against £905,896 twelve months ago. The assets are set down at £1,189,349, which, compared with the preceding year, shows an increase of £13,712. There is a surplus of assets over liabilities of £285,705, against £256,879 before. This year's surplus is made up of the following items: Borough fund, £27,724; district fund, £73,811; water-works fund, £102,230; gas-works fund, £74,531; and electricity supply fund, £7347.

Leeds Corporation Gas Coal Contracts.—The Leeds Corporation Gas Committee recently bought a considerable quantity of gas coal and cannel to meet the requirements of the next twelve months. On Friday, Alderman Lowden and other members of the Committee had interviews with the representatives of various coal companies, and also considered offers received from other firms. The buying of an additional 80,000 tons completed the purchases, which are reported to be not on quite so extensive a scale as usual. Taking the whole quantity purchased, the Committee have been able to buy at an average reduction of 7d. a ton on last year's prices.

The Proposed New Reservoir for Rochdale.—After mature consideration, the Rochdale Water Committee have unanimously decided to indefinitely postpone the construction of the proposed additional reservoir at Ramsden, which was recently recommended by a Sub-Committee on the advice of Mr. J. Mansergh. From the time this scheme was formulated, feeling in the town has been strongly hostile to it, inasmuch as it is thought the existing works will be adequate for another nine or ten years. At the last meeting of the Water Committee, Mr. Ormerod moved, and it was agreed, that the construction of new filter-beds (to enable the storm water at the present reservoir at Ramsden to be used) be proceeded with, and that the Corporation, when they next go to Parliament, seek an extension of the time-limit within which the work of making the new reservoir was to be commenced under the provisions of the Act of 1898.

Messrs. George Newton and Co., Limited, of Oldham (The Richmond Gas Stove and Meter Company, Limited), have just supplied to the Birmingham University a 1000-light meter.

Additional scrubbing and washing plant has recently been completed at Ardrossan, Long Eaton, Wallasey, Teignmouth, Brentwood, and Arbroath; the extensions in each case being carried out by Messrs. W. C. Holmes and Co., of Huddersfield, in the supply and erection of their patent "New" scrubber-washer.

A destructor of Meldrum's "Simplex" regenerative type, comprising a two-grate unit destructor, regenerator, Lancashire boiler, 26 feet long and 7 feet in diameter, together with a Sugden superheater placed in the downtake, has been erected at Sheerness for generating steam for pumping the town's water supply. Two coal-fired boilers were previously employed, at a fuel cost of £500 per annum. Now 10 tons of refuse, destroyed daily at the rate of a ton per hour, furnish a similar quantity of steam, apart from the economy effected in scavenging.

THE "MAIN" GAS COOKER

With Latest Developments.

Our New Enamelled Plates are Unequalled for Durability and Appearance.

R. & A. MAIN, LTD.,

LONDON, GLASGOW, BIRMINGHAM, MANCHESTER, BRISTOL.

Factories: LONDON AND FALKIRK.

WATER SUPPLY AND RIVER POLLUTION.

At the Congress of the Royal Institute of Public Health recently held in Liverpool, a paper on the above subject was read by Mr. JOSEPH PARRY, M.Inst.C.E., the Corporation Water Engineer.

The author began by referring to the water supply of Liverpool, and pointed out that the Corporation had always displayed a very liberal and far-seeing spirit in reference to this matter. True to their policy of making ample provision for the future, they had commenced to lay a second line of pipes from Lake Vyrnwy, to utilize still further the yield of that gathering-ground. This new pipe-line would cost about £1,000,000, and when completed would place the Corporation in possession of sufficient water at their own door to furnish 30 gallons per head per day to 1½ million people.

Passing on to the general question of water supply, he asked what, speaking broadly, was the position of the country to-day with regard to this vital matter. The principle was now almost universally accepted that the provision of water for any town or district should be undertaken by the local authority, and should not be left to private enterprise, or carried on for private gain. The local authorities on whom this duty devolved found themselves called upon to satisfy a much higher standard, both as to quality and quantity, than was accepted a few years ago. Recent scientific progress, and particularly the progress made in bacteriology, had revealed the existence of impurities and dangers to health which formerly were only suspected, and which eluded the tests of the chemist. This had led to a demand for water free from such impurities, and not exposed to contact with pathogenic organisms.

While this demand for a higher degree of purity was being made, the medical experts, who made a special study of public health, were asking for a much more liberal use of water than had hitherto been considered necessary. Their cry was for pure water, and more of it. In trying to meet this demand, they realized how limited were the available resources of the country, and the difficulty of finding new ones capable of yielding good and wholesome water in sufficient quantity pressed with especial severity upon small manufacturing towns and rural districts. These difficulties were of a serious character; and they would inevitably become still more so, not only with the growth of population and trade, but also as many of the present sources come to be condemned and rejected.

This led the author to one conclusion, which appeared to be self-evident, but which required a practical application. It was that all local authorities, and all supporters of health congresses and sanitary associations of every kind, should co-operate to protect and preserve the natural water resources of the country, and to distribute those resources as freely and cheaply as the conditions would permit. To apply this principle in a practical form, he invited them to consider two of the many ways in which the action or inaction of local authorities might be prejudicial. One of these was the rating of water-works. Both the law and practice relating to the fixing of assessments were notoriously defective and unsatisfactory, and many attempts at reform had been made, though so far without success. The reforms most urgently needed, were the adoption of one uniform method of rating, and the simplification of the machinery for determining the amounts. He appealed to local authorities to look at the subject from the point of view of the public health, and co-operate in removing any obstacles that tended to interfere with the adoption of new water schemes.

Turning to the question of the pollution of rivers, the author drew attention to the recommendations of a succession of Royal Commissions, emphasizing the importance of the general protection of our rivers, and the formation of Rivers Boards to exercise jurisdiction over the watersheds, and to enforce the provisions of the Rivers Pollution Prevention Act. He hoped that a measure so consistently recommended would not long be delayed.

In conclusion, Mr. Parry asserted that a great deal of the failure to carry out works for water supply and purification, especially in rural districts, arose from the difficulty and expense of obtaining the best expert advice, and the cost of chemical and bacteriological analyses. If they had a central authority thoroughly well equipped, from which practical advice and guidance could be obtained free of cost, it would, he was convinced, be of immense benefit in securing the distribution and preservation of wholesome water and generally in the promotion of health. He urged upon his audience the importance of doing all they could, by their influence, their practical action, and the spread of information, to create a public opinion favourable to reform in these matters, and to teach the public to prize the streams and rivers of our country as invaluable natural possessions, not to be sacrificed to selfish interests, but to be carefully guarded and protected, and their purity and beauty preserved for the advancement of public health and the better enjoyment of life.

In the course of the discussion upon the paper, Mr. W. Whitaker, F.R.S., said he was in agreement with the author on the main points brought forward, but was inclined to think that public opinion was in advance of that of the Government. Mr. Meade-King referred to the difficulties to be met with in the country in the way of the prevention of pollution, and spoke in favour of the taxation of ground values as another source of income, which would enable the authorities to cope with the obstacles in the way of the provision of light and air and pure water. Mr. Parry, in reply, said that he thought Parliament did not require educating so much as the rural district authorities and the general public.

Messrs. Samuel and Josiah Chandler (Messrs. S. Chandler and Sons) have removed their offices to 39, Victoria Street, Westminster.

The Aspatria Gas Company have placed an order with Messrs. R. Dempster and Sons, Limited, for two condensers, a Livesey washer, and exhauster, &c.

The balance at the credit of the net revenue account of the Brentford Gas Company, subject to audit, will enable the Directors to recommend dividends for the past half year at the rates of 5, 12, and 9 per cent. per annum, carrying forward £52,043.

The Leeds City Council are desirous of borrowing £100,000 for the purpose of extending and enlarging their water-mains; and last Thursday a Local Government Board inquiry relative to the matter was held by Mr. W. O. E. Meade-King. There was no opposition.

Mr. Joseph Townsley, foreman at the Ashton-under-Lyne Gas-Works, who has accepted the position of general foreman at the Birkenhead Gas-Works, was recently presented by the officials and workmen with a silver chronometer, as a memento of the good feeling entertained towards him.

At a meeting of the Directors of the National Gas-Engine Company on Thursday, it was resolved to pay an interim dividend at the rate of 5½ per cent. per annum on all preference shares, and 15 per cent. per annum on all ordinary shares, for the six months ending June 30—in both cases less tax.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

BANK HOLIDAY.

In consequence of the BANK HOLIDAY (Aug. 3), Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than THE FIRST POST ON SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half-Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in Advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 5s. 6d., payable in Advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

DRAUGHTSMAN. Jenkins and Co., Retford.
FITTER AND SMITH. No. 4072.
LAMP-WORKS MANAGER. S., care of Vickers, London.
MAIN AND SERVICE LAYER. Dumfries Gas-Works.
PRODUCER GAS EXPERT. South Staffordshire Mond Gas Company.
STOKERS (Leading). Worthing Gas-Works.
SUPERINTENDENT (Gas and Chemical Works). Sheffield Gas Company.
WORKING FOREMAN. Atherton Gas-Works.
WORKING FOREMAN. Stratford-on-Avon Gas-Works.
WORKS FOREMAN. Dumfries Gas-Works.

Situations Wanted.

ASSISTANT GAS MANAGER, &c. "R.," Bedford.
ASSISTANT TO ENGINEER. No. 4059.
LECTURER ON GAS COOKING, &c. Madame Alting-Mees, London.
REPRESENTATIVE OF ENGINEERING FIRM. No. 4063.

Plant, &c., for Sale.

EXHAUSTER (15,000 feet per hour). Woolton Gas-Works.
METER (3000 cubic feet capacity). Marshall, Kaye, and Marshall, Ravensthorpe.
PURIFIERS, &c. Bathgate Gas Company.
STATION METER AND GOVERNOR. Chard Gas-Works.

Plant (Second-Hand) Wanted.

CONDENSERS, &c. Cowdenbeath Gas-Works.
PURIFIERS (two). Coward and Co., London.

Meetings of Companies.

BRENTFORD GAS COMPANY. Aug. 7.
BROMLEY GAS COMPANY. Aug. 11.
CRYSTAL PALACE DISTRICT GAS COMPANY. Aug. 14.
GASLIGHT AND COKE COMPANY. Aug. 7.
HORNSEY GAS COMPANY. Aug. 7.

Stock Wanted in Cromer Gas Company.

No. 4071.

TENDERS FOR

Boilers.
COVENTRY GAS DEPARTMENT. Tenders by Aug. 1.

Coal and Cannel.
BEVERLEY GAS DEPARTMENT. Tenders by July 29.
PADIHAM GAS DEPARTMENT. Tenders by Aug. 6.
SHEFFIELD GAS COMPANY. Tenders by Aug. 10.

Gasholder, &c.
DEVONPORT GAS DEPARTMENT. Tenders by Aug. 29.

Gasholder Tank.
DEVONPORT GAS DEPARTMENT. Tenders by Aug. 29.

Ironwork (Wrought and Cast).
COVENTRY GAS DEPARTMENT. Tenders by Aug. 1.

Oil for Gas Making.
SMETHWICK GAS DEPARTMENT. Tenders by July 30.

OXIDE OF IRON.

O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.,

JOHN WM. O'NEILL, Managing Director,

PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

GAS TAR wanted.

BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.

Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

SULPHURIC ACID for Sale.

BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

STREET AND SHOP LAMPS AND LANTERNS.

MARK DUFFIELD & SONS (Established 200 Years), Makers of Street and Shop Lamps to own Pattern and Design. Any description of Lamp made. Inquiries invited.

London Manager: EDWARD PADFIELD, West India House, 96 & 98, LEADENHALL STREET, E.C.

Telegraphic Address: "EUPATHY, LONDON."

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,

VICTORIA PAINT WORKS,

MANCHESTER.

Telegrams: "ENAMEL." National Telephone 1759.

PATENTS AND TRADE MARKS

PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

THE Pipe Union Clip Company,

HOLMES CHAPEL, near CREWE, Sole Manufacturers of the PATENT UNION CLIP, which ensures that all Gas used passes through the Meter. Many Companies already use them with quite astonishing results.

Prices and other Particulars on application.

GENTLEMAN, Seven Years' Experience in the Gas World, wishes to REPRESENT a Firm of Manufacturers.

Address No. 4063, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

THE First Dutch Bog Ore Co., Ltd. (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

General Manager for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.

General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.

SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.

Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 311 AVENUE.

RE Advertisement for General Clerk and METER INSPECTOR. Applicants are THANKED; the appointment being now FILLED.

G. STEVENSON,
Secretary and Manager.

Gas-Works, Long Eaton,
July 20, 1903.

MADAME ALTING-MEES, Diplomée Paris, Londres, Bruxelles, "LECTURER ON GAS COOKING," is now booking dates for Lectures on the Continent and at home. Would accept a suitable permanent post as Demonstrator.

Write for terms for Lectures and Price of Pamphlet, "La Cuisine au Gaz," to Madame ALTING-MEES, 102, Sinclair Road, Kensington, LONDON, W.

WANTED, a Situation as Assistant in Gas-Works, by the Son of a late Manager and Lessee. Is a practical Plumber and Gas Engineer. Willing to sacrifice for beginning. Highest References. Age 26.

Address, "R.", care of LOWE, Stationer, Bromham Road, BEDFORD.

ADVERTISER (age 22), B.Sc., Honours Degree in Engineering, College Certificates in Civil and Mechanical Engineering, Pure and Applied Mathematics, Chemistry and Physics (with Honours in Civil and Mechanical Engineering and Pure Mathematics), First-Class Honours "Gas Manufacture," City and Guilds, qualification for Assoc.M.Inst.C.E., &c., Three-and-a-half Years practical Works' Experience, One Year Office, Three Years College Training, seeks position in modern Works as ASSISTANT to Engineer of recognized standing in the Gas Industry. Excellent References.

Address No. 4059, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Good Draughtsman. One with experience in Gas-Works Coal and Coke Handling Plant preferred.

Apply, by letter, stating Salary desired, to W. J. JENKINS AND CO., LIMITED, RETFORD.

GENERAL Works Foreman Wanted. Must be a good Carbonizer and thoroughly understand Regenerative Settings. Wages to commence, 40s. per week.

Particulars of Experience and References to G. MALAM, Manager, Gas-Works, DUMFRIES.

MAIN and Service Layer Wanted. A thoroughly Practical Man who thoroughly understands the Testing for Leakages. Wages to commence, 35s. per week.

Particulars of Experience and Reference to G. MALAM, Gas-Works, DUMFRIES.

FITTER and Smith Wanted, used to the Routine of a Gas-Works. A qualified Mechanic preferred.

Apply, by letter, stating all Particulars as to previous and present Employments, Age, and Wages required, to No. 4072, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKING FOREMAN.

WANTED, a thoroughly Practical Man as GENERAL FOREMAN for a Gas-Works producing about 70 million cubic feet per annum. Wages 40s. per week.

Apply, by letter, with References, to Mr. D. SCHOFIELD, Clerk to the Urban District Council, ATHERTON, near Manchester.

COAL GAS TAR wanted.

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL.

5, CROOKED LANE, LONDON, E.C.

PRODUCER GAS.

WANTED, an Expert in the application of Producer Gas to Industrial (heating) Operations, to conduct Experiments, and Advise Customers in its use.

Apply, by letter, stating Age, Experience, Salary, and References, to the SOUTH STAFFORDSHIRE MOND GAS COMPANY, Trindle House, DUDLEY.

WORKS MANAGER.

WANTED, a Man with Experience of the Conduct of a First-Rate Engineering Shop, to undertake the Management of a Lamp Manufacturing Works. Must be a good Organizer, thoroughly versed in Workshop Practice, and accustomed to Interviewing people and firms of good standing.

Applications to State (in confidence) Age, Previous Experience, and Salary required, to "S.", care of J. W. VICKERS, 5, NICHOLAS LANE, E.C.

STRATFORD-UPON-AVON CORPORATION.

(GAS DEPARTMENT.)

WANTED by the above, a Working FOREMAN with a good knowledge of the routine of a Gas-Works making about 60 Millions. To an active young man, the above offers a favourable opportunity of improving his position. A total abstainer preferred.

Wages to commence at 35s. per week.

Apply, with recent Testimonials and References, to

J. S. CRANMER,
Manager.

July 25, 1903.

WORTHING GAS COMPANY.

TO RETORT-HOUSE HANDS.

WANTED, Two thoroughly Steady, Competent, and Reliable Leading STOKERS, accustomed to Regenerative Furnaces, and the efficient control of workmen. During the months of December and January, the leading stokers are relieved of active stoking, in order to ensure the best possible supervision during this period. Eight days' Holiday allowed each year. Wages 36s. 6d. per week of seven days.

None but thoroughly Reliable Men who are able to forward recent Testimonials of their fitness for the post need apply.

Apply at once, by letter or personally, to W. A. WALKER, Engineer and Manager.

SHEFFIELD UNITED GASLIGHT COMPANY.

THE Directors of this Company require a SUPERINTENDENT for their Grimesthorpe Gas and Chemical Works.

The present maximum make of Gas is 5 million cubic feet per day; Sulphate of Ammonia, about 3000 tons per annum; and Sulphuric Acid, about 2500 tons per per annum.

Salary £300 per annum, with House, rent free.

Applications, marked "Superintendent," stating Age and previous Engagements, to be made by letter only, addressed to the undersigned, not later than Monday, Aug. 10, 1903.

Testimonials not to be sent till asked for.

HANBURY THOMAS,
General Manager and Secretary.

Gas Offices, Commercial Street,
Sheffield, July 18, 1903.

CROMER GAS STOCK.

WANTED to Purchase a Small Amount.

Full Particulars and Price to No. 4071, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Gas Carbon, in Four Ton Lots or more, f.o.r. Must be Clean and Hard Lumps.

Address No. 4044, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TWO Second-hand Purifiers Wanted, 12 ft. by 12 ft., complete with 9-inch Centre Valve, to work One, Two, Three, or Four Purifiers, and Overhead Handy Traveller for Covers.

Write WM. COWARD AND CO., 91, Finsbury Pavement, LONDON.

CONDENSERS wanted, or Condenser Chest, for 8-inch to 10-inch Pipes. Must not be more than 3 feet broad, with or without Stand and Bridge Pipes.
Write, giving sketch or full Particulars, to the GAS MANAGER, Cowdenbeath, FIFE.

TO BE SOLD—Purifiers, Two or Four, 10 feet square by 4 ft. 6 in. deep, planed Joints, Connections, and Overhead Girders.
Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE - 20-inch Valves, Tees, BENDS, CROSSES, &c., Second-Hand, Cheap. In Good Condition. Makers, Newton Chambers.
Apply to DUXBURY & Co., MANCHESTER.

WANTED, Offers for One 15,000 cubic feet per hour Dempsters' PATENT DIRECT-ACTING DOUBLE CYLINDER EXHAUSTER, with Engine on same Bed-Plate.
For further Particulars, apply to the MANAGER, Gas-Works, WOOLTON.

FOR SALE—Two Purifiers, 10 ft. by 8 ft. by 4 ft. deep, with 9-inch Four-Way Valves and Connections; also Lifting Apparatus. All in First-Class Order.
Apply BATHGATE GAS COMPANY, LTD., BATHGATE, N.B.

TAR Contracts Wanted on the Sliding-Scale or at Fixed Prices
Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND Co., Ouse Chemical Works, SELBY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE—A 3000 Cubic Feet per Hour STATION METER; also STATION GOVERNOR, with 6-inch Valves, Connections, and Bye-Pass. Too small for present requirements. May be seen at work.
For further Particulars, apply to the MANAGER, Gas Offices, CHARD.

FOR SALE—A large Wet Meter, suit- able for Gas-Works. Capacity 3000 cubic feet per hour, 6-inch Inlet and Outlet Pipes, with Water Gauge Box, &c. Made by W. & B. Cowan. In Excellent Condition.
Apply to MARSHALL, KAYE, AND MARSHALL, LIMITED, Ravensthorpe, YORKSHIRE.

DEVONPORT GAS-WORKS.

CONTRACT No. 6.

GASHOLDER TANK.

THE Corporation of Devonport are pre- pared to receive TENDERS for the construction of a GASHOLDER TANK at their Works.
Copies of the Specification and Drawings can be seen, on and after Wednesday, the 29th of July, 1903, at the Manager's Office, Gas-Works, Devonport, or at the Office of the Engineers, Messrs. Stevenson and Burstal, 38, Parliament Street, Westminster.
Copies of the Tender and Bill of Quantities can be obtained from the above-mentioned on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.
The Corporation do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, in accordance with the instructions at the head of the Tender, are to be delivered to the undersigned not later than Saturday, the 29th day of August, 1903.

SIDNEY E. STEVENSON,
Engineer and Manager.
Gas-Works, Devonport.

DEVONPORT GAS-WORKS.

CONTRACT No. 7.

TELESCOPIC GASHOLDER AND APPENDAGES.

THE Corporation of Devonport are pre- pared to receive TENDERS for the Construction and Erection of a TELESCOPIC GASHOLDER and APPENDAGES at their Works.
Copies of the Specification and the Drawings can be seen, on and after Wednesday, the 22nd day of July, 1903, at the Manager's Office, Gas-Works, Devonport, or at the Office of the Engineers, Messrs. Stevenson and Burstal, 38, Parliament Street, Westminster.
Copies of the Tender and Bill of Quantities can be obtained from the above-mentioned on payment of One Guinea, which will be returned upon receipt of a *bonâ-fide* Tender.
Should intending Contractors so desire, they can obtain copies of the Drawings upon payment of Two Guineas by applying to the Engineers.
The Corporation do not bind themselves to accept the lowest or any other Tender.
Sealed Tenders, endorsed in accordance with the instructions at the head of the Tender, to be delivered to the Deputy Town Clerk, Devonport, not later than Saturday, the 29th day of August, 1903.

SIDNEY E. STEVENSON,
Engineer and Manager.
Gas-Works, Devonport.

TENDERS FOR COAL AND CANNEL.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for GAS COAL, NUTS, and CANNEL for delivery during the period ending June 30, 1904; the Tenders to state whether the Coal is screened or unscreened.
Tenders (Form for which can be obtained on application) must be delivered to the undersigned not later than the first post on Monday, the 10th day of August.
The Directors reserve the right to take the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager and Secretary.
Commercial Street,
Sheffield, July 25, 1903.

TO IRONFOUNDERS AND SMITHS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the Manufacture, Construction, and Erection at their Foleshill Works of about 110 Tons of Cast and Wrought IRONWORK, comprised in Roofs, Columns, Girders, Elevated Water and Liquor Tanks, &c.
The Specification, with Form of Tender and Schedule of Quantities, together with prints of the Drawings, may be obtained from the undersigned on payment of One Guinea, which will not be returned.
The Committee do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and endorsed "Tender for Ironwork for Sulphate Works and Liquor Tanks," must be delivered on or before Saturday, the 1st of August next.

FLETCHER W. STEVENSON,
Engineer and General Manager.
Gas-Works, Coventry,
July 13, 1903.

TO BOILERMAKERS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the Manufacture and Delivery at their Foleshill Works of a Lancashire BOILER 30 ft. long by 7 ft. 6 in. diameter.
The Specification, with Form of Tender, may be obtained from the undersigned on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.
The Committee do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and endorsed "Tender for Lancashire Boiler," must be delivered on or before Saturday, the 1st of August next.

FLETCHER W. STEVENSON,
Engineer and General Manager.
Gas-Works, Coventry,
July 13, 1903.

URBAN DISTRICT COUNCIL OF PADIHAM.

CONTRACT FOR COAL.

THE above-named Council invite Ten- DERS for a supply of 5500 Tons of Best Screened GAS COAL, for One or Two Years, to be delivered free between the 1st of August and the 31st of July during each or either Year of the Contract.
Forms of Tender and Conditions to be obtained from Mr. A. J. Jackson, Engineer and Manager, Gas-Works, Padiham.
Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas and Water Committee, to be delivered at my Office on or before Twelve o'clock of the forenoon of Thursday, the 6th day of August, 1903.
The Council do not bind themselves to accept the lowest or any Tender.

JAS. C. WADDINGTON,
Clerk to the Council.
Council Offices, Padiham,
July 20, 1903.

BOROUGH OF SMETHWICK.

GAS OIL.

THE Gas Committee are prepared to receive TENDERS for the supply of about 120,000 Gallons of OIL suitable for the manufacture of Carburetted Water Gas, delivered free at the Gas-Works, Rabone Lane, Smethwick, in such quantities and at such times as may be required by the Committee, during the period ending the 30th of June, 1904.
Analysis and full Description, with a sealed Sample of the Oil offered, must be sent with Tender, addressed to the undersigned, not later than the 30th of July inst.
The Committee do not bind themselves to accept the lowest or any Tender.

By order,
W. J. STURGES,
Secretary.
Gas Offices, Town Hall,
Smethwick, July 17, 1903.

BOROUGH OF BEVERLEY.

TENDERS FOR COAL.

THE Gas Committee are desirous to re- ceive TENDERS for the supply of not exceeding 7000 Tons of COAL, for use at the Gas-Works, Beverley, for a period of Twelve Months from the 1st of October next, to be delivered as from time to time directed, and at the expense of the Contractors, f.o.b. at Keadby, or at the Pits or at the Railway Station, Beverley, according to terms of Contract.
The Coal to be of the best kind, well-screened, free from Sulphur, Bats, Bind, Refuse, and Dirt, and to be weighed 21 cwt. to the Ton upon the Corporation Machine.
Payments will be made from time to time so long as the Contractors shall duly fulfil the Contract.
The Corporation do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to divide the Contract as they think fit.
Further Information and Forms of Tender may be obtained of the Gas Manager, Mr. F. W. Oldfield, at the Gas-Works, Beverley, and Tenders, endorsed "Tender for Coals," must be delivered at my Office not later than Wednesday, the 29th day of July, 1903.

J. WILLIS MILLS,
Town Clerk.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at this Office on Friday, the 7th day of August next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 30th day of June last.
Notice is Hereby also Given, that, at such Meeting, the Directors will submit to the Proprietors, for their approval, a Resolution determining, in accordance with the provisions of the Companies Clauses Consolidation Act, 1845, the remuneration of Mr. Henry Rayner, upon his appointment as Secretary of the Company.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.
Chief Office: Horseferry Road,
Westminster, S.W., July 21, 1903.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street, London, E.C., on Friday, the 14th day of August, 1903, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last, to declare a Dividend for the same period, and for General Purposes.
The TRANSFER BOOKS WILL BE CLOSED from the 31st day of July until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.
Offices and Works:
Lower Sydenham, S.E.,
July 28, 1903.

BRENTFORD GAS COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors will be held at the Charing Cross Hotel, London, on Friday, the 7th of August next, at Three o'clock precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending the 30th day of June last.

By order.
WILLIAM MANN,
Secretary.
Office, Brentford,
July 21, 1903.

BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the "Bell" Hotel, Bromley, Kent, on Tuesday, the 11th day of August, 1903, at Six o'clock p.m. precisely, to receive the Report of the Directors, the Balance-Sheet certified by the Auditors, to declare a Dividend, and to transact generally the business of a General Meeting.
The TRANSFER BOOKS WILL BE CLOSED from the 25th of July to the 11th of August, 1903, both days inclusive.

By order of the Board.
HENRY W. AMOS,
Secretary.
Offices: 156, High Street,
Bromley, Kent, July 25, 1903.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Offices of the Company, No. 63, Chancery Lane, in the County of London, on Friday, the 7th day of August, 1903, at Half-past Three o'clock in the Afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year ended the 30th of June last, to declare Dividends, and to transact the Business of an Ordinary General Meeting.
The TRANSFER BOOKS WILL BE CLOSED from the 25th day of July to the 7th day of August, both inclusive.

By order of the Board,
WILLIAM E. ROBERTS,
Secretary.
Offices: 63, Chancery Lane,
London, W.C., July 21, 1903.

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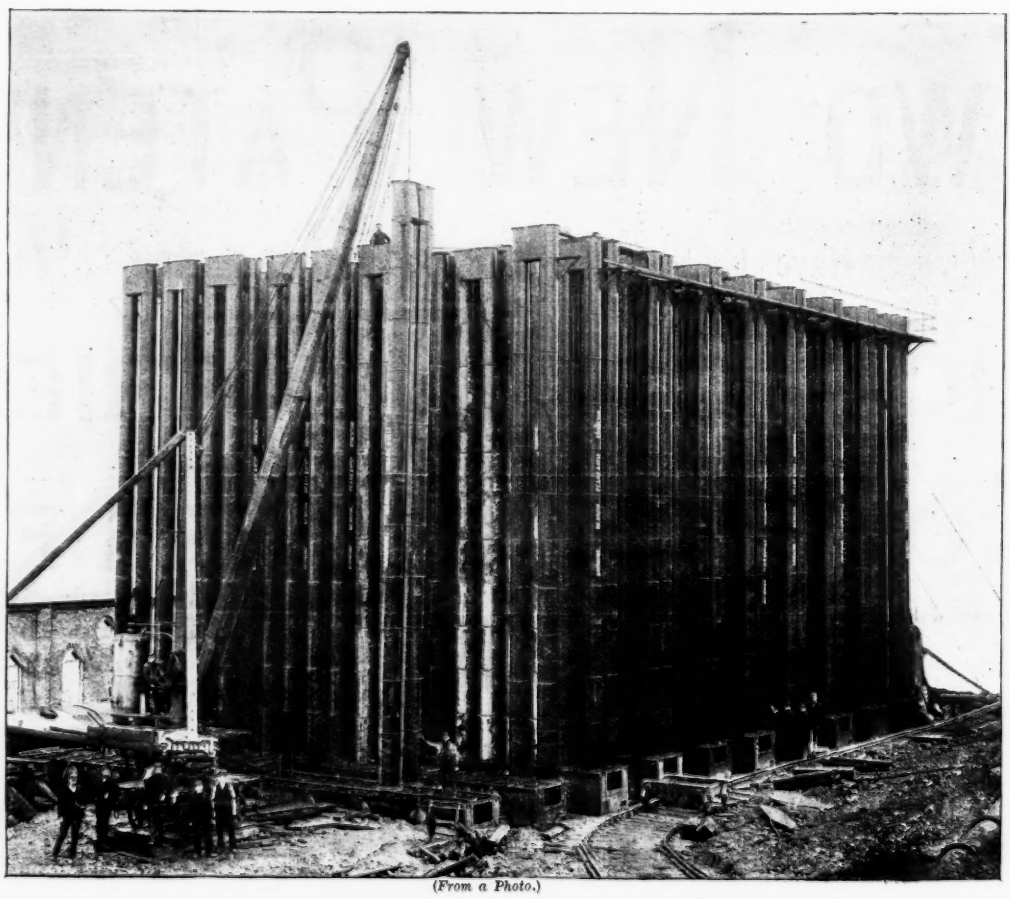

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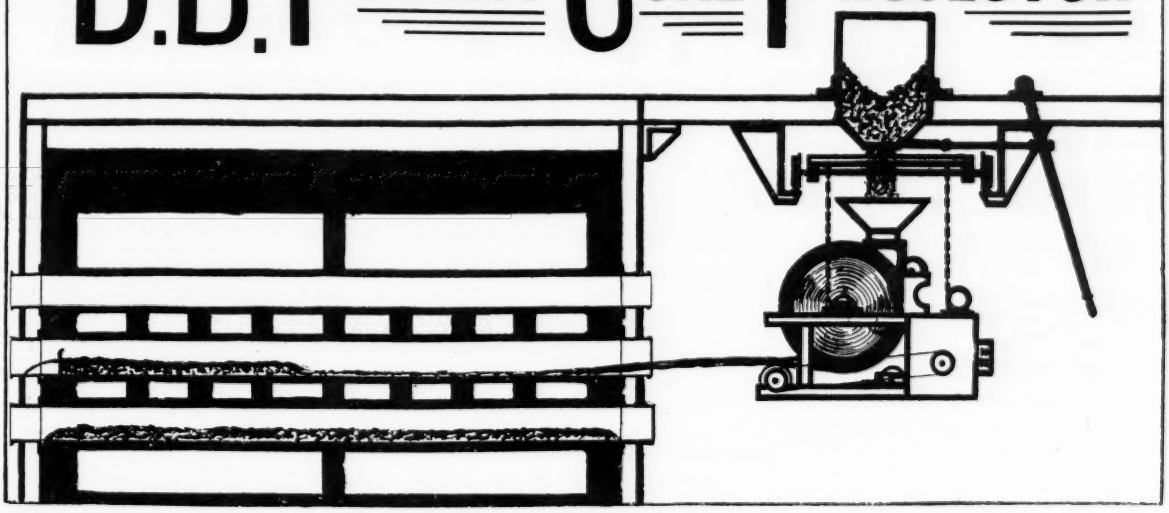

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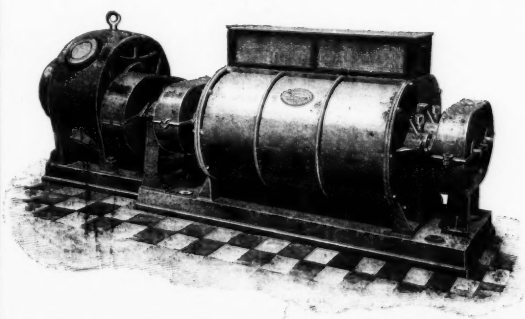

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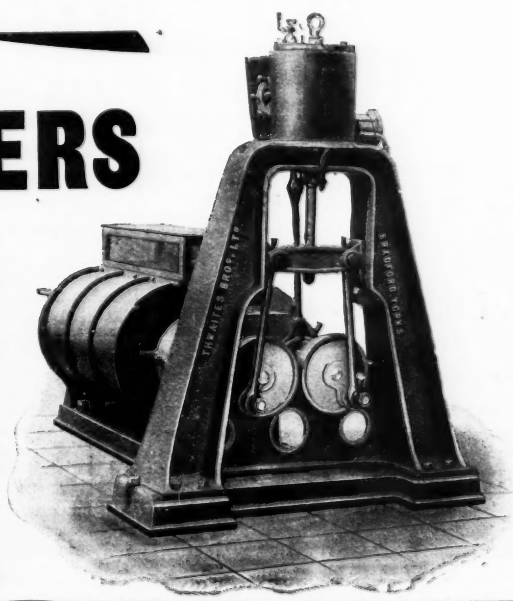

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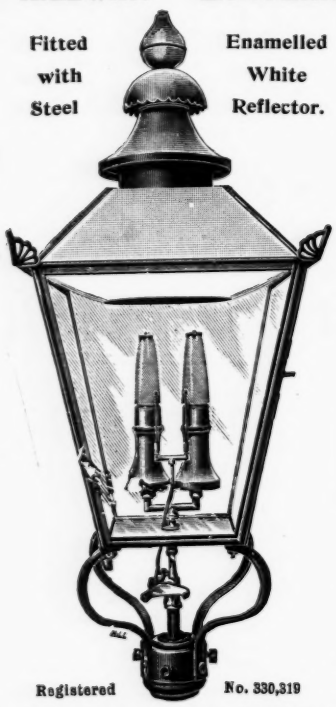

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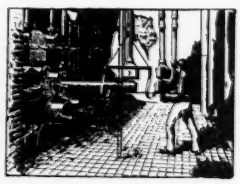

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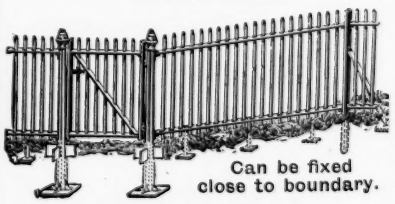

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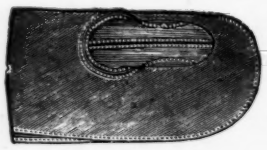

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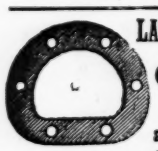

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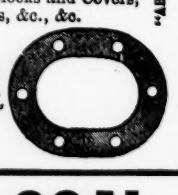

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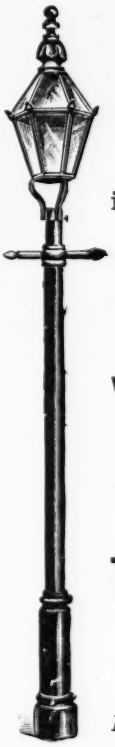

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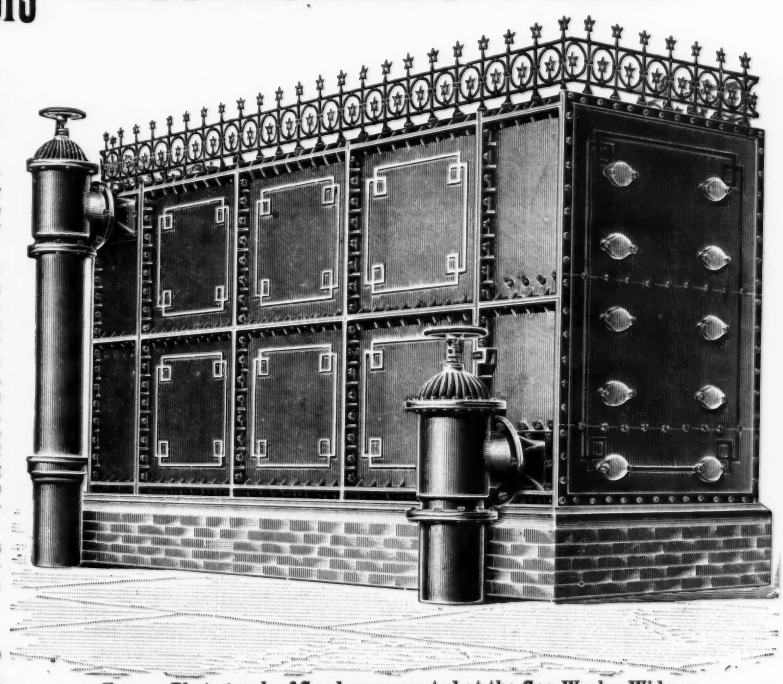

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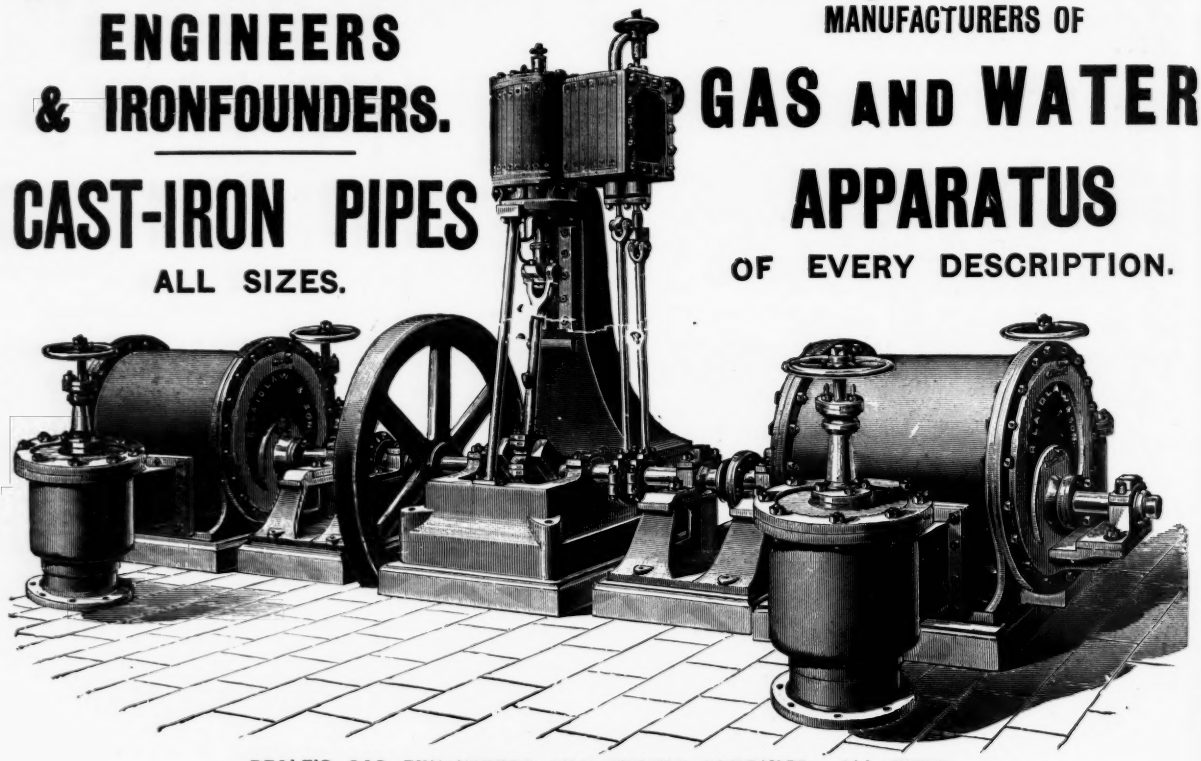

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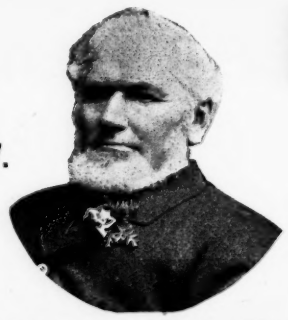

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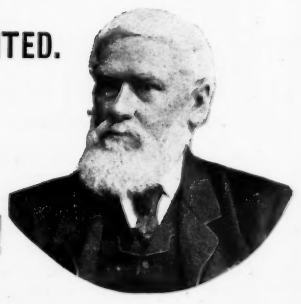

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